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Arts

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TRANSACTIONS

OF THE

Royal SOCIETY of

INSTITUTED AT LONDON

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURE

AND

COMMERCE;

WITH

THE PREMIUMS

OFFERED IN THE YEAR 1824.

VOL. XLIII.

LONDON:

SOLD BY THE HOUSEKEEPER, AT THE SOCIETY'S HOUSE IN THE ADELPHI; AND BY ALL BOOKSELLERS.

1825.

VIEW OF A PORTABLE ROPE BRIDGE CONSTRUCTED BY COLIN SHAR

Drawn by Cornelius Varley

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PREFACE.

THE contents of the present volume consist, for the most part, of descriptions and notices of the various subjects for which the Society have bestowed medals or pecuniary rewards during the last session.

From a perusal of these, the public in general, and those members who are prevented from personally taking a part in the proceedings, may be convinced that no remission has taken place in the activity of the Society, or in the readiness of ingenious persons to submit their inventions to its judgment.

In the class of Agriculture and Rural Economy, the large gold medal has been given to Ralph Creyke, Jun., Esq., for warping, by an improved method, four hundred and twenty-nine acres of peat. It is chiefly on the shores of the Humber that the process of

comparative growth of timber on various soil under different circumstances.

For the last four years the Society have endeav to improve the straw-plat manufacture of the cou with a view of raising it to an equality with tl Tuscany. They first introduced and distributed of an American grass used for this purpose in necticut; they next encouraged experiments fo purpose of ascertaining whether any of our own n grasses might be advantageously used instead; have also endeavoured to collect accurate inform respecting the variety of wheat actually employe Tuscany as the material of their fine plat, and to tain seeds of the same. The Society's premiu twenty guineas for seed of the American grass ra in this country, has been successfully claimed Messrs. Cowley and Staines; and the silver C medal has been voted to Mr. Salisbury for his in esting communication respecting the Tuscan wh derived partly from his own cultivation of the pl from seeds given to him by H. R. H. the Duke Sussex, and partly from information obtained for h by M. Tournier during his journey in Tuscany.

The silver Ceres medal, the premium for an variety of perennial ray-grass, has been award Whitworth: specimens of the plant and se exhibited before the Committee of Agricul from the concurring testimony of those farm have cultivated Mr. Whitworth's grass, it a be decidedly superior to any other known va

In the class of Chemistry, the large silv and fifty guineas have been given to John R working collier, of St. Helens, in Lancashir apparatus to enable persons to breathe in ai with smoke and other suffocating vapours. substances which compose our atmosphere spirable portion amounts to about twenty- cent. of the whole mass; of the remaining nine parts about seventy-eight are an elastic f capable of supporting life, but at the same t erting no actively deleterious properties; one p only consists of gas decidedly noxious if undiluted. Nothing can compensate for a c able deficiency in the usual proportion of the ble part of the atmosphere, but it often occ air is rendered completely noxious by the mi

various irritating vapours or minute floating particles, which, producing a convulsive cough, prevent respiration, although there is nearly the usual quantity of respirable air present. Of these substances some are separable by mechanical filtration, and others are capable of being absorbed by water; while there are others not removeable by either of these methods.—Roberts's apparatus consists of an air-tight hood which covers the head (having glazed apertures in front of the eyes), and prolonged into a pipe or trunk considerably expanded at the extremity: this extremity is covered with thick woollen cloth, and the expanded part is nearly filled with sponge. When the end of the pipe has been dipped for a few seconds in water the apparatus is ready for use; and the committee were witnesses to an experiment in which a close chamber was filled with wood-smoke and the vapour of burning sulphur so as to be completely suffocating: the candidate, with the apparatus on, then entered the chamber, and remained enveloped in the smoke for more than half an hour, without sustaining any material inconvenience, except what arose from the heat. The result of this experiment, considered merely as a philosophical fact, is very inter-

esting, and in its probable practical applications is extremely important. It offers to firemen and others the means of penetrating into parts of buildings on fire, and especially of ships, which otherwise, from the suffocating effect of the smoke, would be inaccessible, in order to extinguish the flames or to rescue valuable property; and is also applicable in various manufacturing processes, to protect the persons engaged in them from inhaling dust or vapours prejudicial to health.

The large silver medal has been given to Mr. H. Moore for his mode of etching on and cleaning vases and other articles of alabaster; which he effects by availing himself of the solvent power which pure distilled or rain-water exercises on this substance.

The silver Vulcan medal and twenty guineas have been voted to Mr. Anstey for his improved melting-pots for the use of iron and brass founders. The pots are made of Stourbridge clay and gas-coke. On comparative trials of them with the pots now in use for the same purposes, they appear to be much less liable to crack or to break by a casual blow, and to

be far more difficult of fusion, qualities the value of which will be duly appreciated by all those artists who may have occasion to use them.

The large silver medal and thirty guineas have been given to Mr. W. Sturgeon, for his improved electro magnetic apparatus, which he effects by greatly diminishing the size of his galvanic battery, (a part of the apparatus which is usually the most expensive and troublesome to manage), by his simple and ingenious mode of keeping it always when wanted at a maximum of action, by proportionably increasing the magnetic power, and by his use of horse-shoe magnets instead of straight ones, by means of which he exhibits simultaneously with one magnet the reverse motions which take place at each pole. The experiments are also shown on a larger scale than usual, though with a far less cumbrous apparatus, and therefore are peculiarly adapted for exhibition in the lecture room.

The thanks of the Society have been given to Captain Bagnold for his successful application of a well-known process to the preservation of the juice of limes

and lemons for sea store, without the use of rum or other spirits.

Finally, Mr. H. Hennell has c tributed a notice of a comparative analysis, made by him at the request of the Society, of the proportions of morphia contained in British and in Turkey opium, completely confirming the opinions of medical practitioners deduced from the effects of the two upon the human body.

In the class of Mechanics the sum of ten guineas has been given to Mr. Friend for his secret lock; it is on the general principle of the letter locks, but by means of a moveable scutcheon it avoids many of the objections that are usually urged against locks of this construction.

The silver Vulcan medal has been given to Mr. J. P. Hubbard, for his folding chair. Its great simplicity, its extraordinary firmness, the ease with which it is folded, and the small space which it then occupies, are likely to make it a very useful article of furniture on board ship or in camp, and in any other situation

where economy of space and easy portability are objects of any importance.

Mr. C. W. Williamson has had the sum of ten guineas presented to him for an improved smoothing-plane for wooden blocks to be engraved on. The inventor is a working man, and therefore of a class from whom suggestions with regard to the improvement of tools are always received with great complacency by the Society; not only because it is very desirable to encourage ingenuity in such persons, but because none are so likely to make real improvements in tools as those who are in the daily habit of handling them.

The silver Vulcan medal has been given to Mr. T. Griffiths for his expanding wedge for the use of sawyers. In the common way of sawing up a balk into planks, when a cut of a foot or two has been made, a wedge is inserted in order to separate the two cut surfaces from each other, lest they should close upon the saw and impede it. The wedge requires fresh adjustment every two or three feet, and the time thus employed amounts, at the end of the day, to a quantity which it is well worth while to save. The angle of

Mr. Griffiths's wedge is formed of two springs which are compressed when the wedge is first inserted into the cut, and which continually expand in proportion to the progress of the saw, requiring only one adjustment for every twelve feet of cut. It is the opinion of the sawyers who have tried it, that the amount of the saving will be about a shilling a day for each pair of men.

The silver Vulcan medal has been given to Mr. David Matthews for his improved mode of barrowing out soil, as practised by him in clearing the harbour of Bridlington, in Yorkshire. It requires rather less horse power than is usually wanted, as the man is not drawn up together with the barrow, and the serious accidents that not unfrequently arise are thus avoided.

The sum of five guineas has been presented to Mr. E. Pechey for his pump for raising water. One has been put down by him at Bury St. Edmunds, which brings water from a depth of ninety feet. There are two sets of pump rods balancing each other, in which circumstance, and in the mode of joining the different

lengths of pipe, the chief novelty of the invention consists.

The gold Vulcan medal has been awarded to Mr. F. Cluley for a forceps to be used in the operation of lithotomy.

The large silver medal has been given to William Brockedon, Esq. for his mechanical apparatus to assist a weak knee joint.

The sum of twenty guineas has been given to Mr. J. Aitkin for his improved striking part of a quarter clock. The usual combinations have been greatly simplified by this ingenious artist, and his contrivance obtained the unanimous approbation of all the clock-makers who were summoned on the committee.

To Mr. W. Hardy the gold Vulcan medal has been awarded for his instrument for ascertaining very minute intervals of time. The Society have already had the credit of rewarding, and of publishing to the world, his unrivalled astronomical clock, and his inverted pendulum for rendering sensible very small quantities

of vibration. The present instrument was originally constructed for the use of the artillery officers at Woolwich, to determine the flight of shells and other projectiles. It divides a second of time into three hundred equal parts, and though liable to some objections from slight variations in the length of the arc described by the pointer when the spring is in a state of tension or comparative relaxation, has, nevertheless, been thought worthy of presenting to the public.

The large silver medal has been awarded to Captain T. Dickinson, R. N. for his mode of applying percussion powder to the discharge of ships' guns. Every sportsman well knows the advantage in rapidity of fire which a gun discharged by percussion powder possesses over one to which fire is communicated in the old way by means of common priming. In naval actions, where the gun and the object aimed at are both in constant motion, it is obvious that correct aim can be had only for an instant, and therefore that most balls so discharged, even when vessels are only a few hundred yards from each other, will miss their mark. Captain Dickinson, with a laudable attention

to the interests of his profession, has adapted the percussion principle to ship's cannon; from which, if employed, will result some saving of powder, some shortening of the time of naval actions, and some additional advantage to that party which is the coolest and best disciplined.

The gold Vulcan medal has been given to Mr. Cow, for his improved mode of conveying anchors by means of a ship's launch. The usual mode of effecting this is to place the anchor in the boat's stern, and to coil the cable on the gunwale; but this lumbers up the boat, overloads it, and exposes it to the imminent hazard of being swamped in a high sea. To obviate this very pressing danger, attempts have at times been made to sling the anchor beneath the boat, as near as possible in the centre of gravity; none of these, however, succeeded so as to encourage their adoption. Subsequently Mr. Cow took the matter in hand, and by very simple but effectual arrangements, obtained results so satisfactory as to induce the Navy Board to direct that every ship of war of a particular class shall be furnished with a launch fitted up on Mr. Cow's principle. On such evidence of the

utility of the invention the Society had no hesitation in bestowing their reward.

The gold Vulcan medal has been granted to Mr. A. Ainger for his improved centering for arches of wide span, a model of which, of considerable size, was made the subject of experiments by the Committee of Mechanics. The obvious difference between Mr. Ainger's centering and those that have hitherto been used, consists of the introduction into the former of iron bars, for the purpose of taking off, by their tension, much of the strain that would otherwise be thrown on the timbers. This enables him to employ not more than one-third of the customary quantity of timber, by which not only is a great saving of expense effected, but the timbers that are retained are not wounded, and consequently weakened, by the crossing of others, as is usually the case. Another and very important advantage is, that it has little or no tendency to rise in the crown when loaded on the haunches, and therefore requires no counterpoising weight on that part.

The large silver medal and ten guineas have been

given to Mr. C. Sockl, for his new safe valve for steam boilers. The object of this valve is not so much to regulate the working pressure of the steam, as to act in aid of the common valve, by affording an additional aperture in case the steam should acquire a dangerous degree of elastic force. It differs from the plug-valves in common use in this circumstance, namely, that in the latter the plug rises out of its socket in order to allow a vent for the steam, whereas in Mr. Sockl's the socket rises away from the plug: the chief advantage resulting from this is, that if any adhesion should have taken place between the plug and socket it is more likely to be overcome, on account of the great surface of the socket, with its attached copper plate, which are exposed to the action of the steam.

The gold Vulcan medal has been awarded to Colin Shakespear, Esq. postmaster-general of Bengal, for his portable rope-bridge, a model of which is in the Society's possession. A few bamboos and trees of moderate size (such as every water-course in India afford), constitute all the timber required; the other materials consist of rope, in convenient lengths for

carriage on the backs of bullocks, and capable of being united together by hooks and eyes of metal. The general principles of its construction are the same as those of the chain bridges, modified, however, so as to combine the greatest simplicity and portability, qualities which admirably adapt it to civil as well as military use in India and other tropical countries, where, during the periodical rains, every water-course is swelled to a dangerous impassable torrent, while, during the rest of the year, it is either dry or fordable without difficulty. Three bridges on this plan have already been constructed. The first, after being set up for public inspection on the Esplanade of Calcutta, was taken to pieces, and transported eighty miles on the backs of bullocks to a torrent on the road to Benares, where it was set up in twenty-four hours, and preserved the communication entire during the whole of a very stormy monsoon without sustaining the smallest injury. For the picturesque view of this bridge, which forms the frontispiece to the volume, the Society are indebted to the liberality of two of their members, viz. C. Varley, Esq. who presented the drawing, and R. H. Solly, Esq. who defrayed the expense of the engraving and printing.

The thanks of the Society have been presented to Capt. T. M. Bagnold, for his communication of a description received from his brother, Capt. M. E. Bagnold, of the process employed at Bombay for forging swords and twisted gun-barrels in imitation of those made at Damascus.

In the class of Polite Arts, the thanks of the Society have been presented to Mr. Edmund Turrell, for an account of the method employed by him of making etching-ground for engravers; being a confirmation of his paper on etching upon steel, inserted in the last volume. And the silver medal and fifteen guineas have been presented to Mr. Savage for his successful imitation of tinted drawings by block printing in colours.

In the class of Manufactures, the silver Ceres medal and five guineas have been voted to Mr. R. Jones, for cloth made of New Zealand flax. The plant commonly, though improperly, called New Zealand flax is perennial, and its leaves produce a larger proportion of fibre than any other known plant does. It has grown and flourished in gardens both in the south of England and in Ireland, without re-

quiring more care than other hardy herbaceous plants. The strength of the cordage made from it is well known, and induced the Society last year to offer a premium for its extended growth in the British islands. The excellent cloth which Mr. Jones has manufactured of it furnishes an additional motive for its cultivation.

In addition to the rewards already bestowed in the class of Agriculture to improve the manufacture of fine plat, the Society have voted several medals and pecuniary bounties for hats and bonnets platted after the manner of those from Leghorn, and made either of our native grasses, or of spring wheat, dwindled by being sown very thick for this express purpose.

In the class of Colonies and Trade, the gold Ceres medal has been awarded to J. M'Kay, Esq. of the colony of Nova Scotia, for his apparatus for uprooting the stumps of trees, by which he clears the ground for cultivation in a more effectual manner than that at present practised, namely, of felling the trees a foot or two above ground, and leaving the butts and roots

to encumber the soil for years till removed by the gradual process of natural decay.

The gold Ceres medal has also been voted to Messrs. Petchey and Wood of Van Dieman's Land, for making and exporting five tons of extract of mimosa bark for the use of tanners. This is the second premium given by the Society for this subject; it appearing to be of great importance to encourage the production in our own colonies of an article which our extended connexions with South America render more and more necessary; at the same time that it is likely to check the improvident destruction of young oaks for the sake of their bark, and to render possible a return to the old method of felling and seasoning ship-timber, which probably is the most effectual way to check the ravages of dry rot in our navy.

The sum of fifty guineas has been granted to M. le Cadre of the island of Trinidad, for his successful exertions in forming a plantation of clove trees in that colony: a few of his trees have last year become productive, and the quality of the cloves, after a rigo-

rous examination by the best judges of the article in London, has been pronounced to be scarcely inferior to those from Amboyna, which have always ranked the highest in the European markets.

A second edition of the Society's Report on the best means of checking the forgery of bank-notes being in preparation, a request was made to Messrs. Perkins and Heath to allow the insertion of one of their most recent bank-note patterns. The wish of the Society was immediately complied with. A specimen was furnished of such beautiful execution and so difficult of imitation, that an order was given for its insertion in the present volume, as well as in the new edition of the Report. The principles on which the bank-note plates of the above-named gentlemen are formed, have already been detailed in the 38th volume of the Society's Transactions, accompanied by specimens: on comparing them with those inserted in the present volume, it will be seen how great an improvement has taken place in the practical application of those ingenious processes by which the notes composed by Messrs. Perkins and Heath are characterized.

The Society have also directed the publication in the present volume of a very interesting account by A. Stephenson, Esq. of the culture of silk in the south of France. The memoir has been for several years in the Society's possesion, and is now printed as likely to be of material service to those who are turning their attention to the growth of silk in England and the British colonies.

The friends of the Society will be gratified to hear that one hundred and fifty-three new members were elected during the last session.

PREMIUMS

OFFERED IN THE SESSION

1825-1826.

A LIST OF THE OFFICERS OF THE SOCIETY.

PRESIDENT,

HIS ROYAL HIGHNESS PRINCE AUGUSTUS FREDERICK DUKE OF SUSSEX, K. G. &c. &c.

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CHARLES WAISTELL, Esq.
LAYTON COOKE, Esq.

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JOHN SMITH, Esq.

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THOMAS GILL, Esq.
BRYAN DONKIN, Esq.

Chemistry.

HENRY COXWELL, Esq.
GEORGE DEACON MIDGLEY, Esq.

Colonies and Trade.

WILLIAM EVANS, Esq.
JOHN MACARTHUR, Esq.

Miscellaneous Matters.

Captain T. M. BAGNOLD.
DAVID POLLOCK, Esq.

Secretary, ARTHUR AIKIN, Esq. *F.L.S.*
Assistant-Secretary, Mr. THOMAS WOODFALL.
Housekeeper, Miss A. B. COCKINGS.
Collector, Mr. JOSEPH CHATER.

ADVERTISEMENT TO THE PUBLIC.

The chief object of the Society is to promote the Arts, Manufactures, and commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for the communication to the Society, and through the Society to the public, of all such useful Inventions, Discoveries, and Improvements, (whether specified in these premiums or not), as tend to that purpose: in pursuance of this plan, the Society have already expended upwards of a *Hundred Thousand Pounds*, derived from voluntary subscriptions and legacies.

The meetings of the Society are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The committees meet on other evenings in the week during the session, for the purpose of taking into consideration the subjects referred to them by the Society. A person desirous of becoming a member of the Society, may be proposed according to the following form, which must be signed by three members of the Society, and delivered in to the Secretary:

A. B. [*Trade, profession, or designation of the candidate.*] proposed as a Member of the Society for the Encouragement of Arts, Manufactures, and Commerce, by
C. D.
E. F.
[*Date.*] G. H.

Peers of the realm, or lords of parliament, are, on their being proposed, immediately ballotted for: the names of other persons proposed to become members are read by the secretary to the Society, and are then inserted in lists which are hung up in the Society's room; they are ballotted for at the second following ordinary meeting. In both cases, if two-thirds of the members then voting ballot in their favour, they are deemed perpetual members upon payment of not less than twenty guineas in one sum, or subscribing members upon payment of any sum not less than two guineas annually.

Ladies are eligible as members of the Society, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a member, on his producing a written authority for the same.

Members are entitled to vote and assist in all the business of the Society and of the several committees. They have also the privilege of recommending two persons as visitors at the meetings of the Society; and, by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various models, machines, and productions, in different

branches of arts, manufactures, and commerce, for which rewards have been bestowed; also to inspect the magnificent series of moral and historical paintings, executed by the late J. Barry, Esq., which, with some valuable busts, statues, portraits, &c. decorate the public rooms of the Society.

Members have the use of the Society's library, which is valuable, and annually increasing by the purchase and donation of scientific and useful books, and of engravings. Contributions from members and others, in augmentation of the library, and of the collection of maps and prints, will be thankfully received, and duly acknowledged in the annual volume of the Society's Transactions, to a copy of which every member is entitled.

☞ To persons inclined to leave a sum of money to this Society by will, the following form is offered for that purpose:

> ITEM.—I give and bequeath to A. B. and C. D. the sum of upon condition, and to the intent that they, or one of them, do pay the same to the collector, for the time being, of a Society in London, who now call themselves *the Society for the Encouragement of Arts, Manufactures, and Commerce;* which said sum of I will and desire may be paid out of my personal estate, and applied towards carrying on the laudable designs of the Society.

The Society desire it to be clearly understood, that as a body they are not responsible for any opinion or representation of facts contained in their volumes. And the public are requested to guard against imposition from persons advertising as having patents for articles rewarded by the Society; they are also cautioned against purchasing articles sold under the pretended sanction of the Society's name.

The Society have lately published the 42d *volume* of their Transactions, which may be had by members, on application to to the housekeeper. Complete *sets* of their *Transactions*, or any single volume, may be purchased at the Society's house; where may be had also,

An *Analytical Index of the first twenty-five volumes* of the Transactions to the termination of the session, June, 1807, price 1*s*.

Ditto continued to the end of the 40th volume, price 1*s*.

A catalogue of books in the Society's library, 1*s*.

A description of Mr. Barry's paintings in the great room of the Society, *gratis*.

All communications are to be made by letter, addressed to *Arthur Aikin*, Esq. the secretary, at the Society of Arts, &c. Adelphi, London; and, where articles are sent by sea for the Society, the bills of lading are to be addressed to the care of *William Vaughan*, Esq. 70, Fenchurch-street, London, who has undertaken to receive them for the Society.

GENERAL NOTICE TO CANDIDATES.

THE great object of the Society in rewarding individuals, is to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large. Candidates are therefore requested to observe, that if the means by which the respective objects are effected require an expense or trouble too great for general purposes, the Society will not consider themselves bound to give the offered reward; but though they expressly reserve the power, in all cases, of giving such part only of any premium as the performance shall be adjudged to deserve, or of witholding the whole if there be no merit, yet the candidates may be assured the Society will always judge liberally of their several claims.

The Society by no means restrict their liberality to the subjects for which premiums are specially offered, but will take into consideration, and will reward by a bounty proportioned to its merit, any communication, the subject of which is of a practical nature, and calculated to promote the public good.

All communications are to be made by letter, addressed to the secretary; and are to contain full and particular details, according to the nature of the subject, as well as accurate descriptions of such drawings and models as form part of the communication: the models to be sent *carriage paid.*

In those cases in which certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in the words of the conditions attached to the respective premiums, and be signed by disinterested persons, who have a positive knowledge of the facts stated.

The premiums are designed for the United Kingdom, unless expressly mentioned to the contrary; but no claim will be attended to unless the previous conditions have been fully complied with.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained any premium or reward from any other society, or for which he has obtained, or purposes to obtain a patent: it being a condition stipulated with every candidate, that all articles rewarded by the Society shall be freely given up to the public, to be made or manufactured by any person whatever.

All models, the production of which is attached as a condition to any premium, shall, upon the delivery of such premium, remain the property of the Society.

Where premiums or bounties are obtained in consequence of specimens produced, the Society will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No member of this Society shall be a candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medals of the Society.

No candidate, not a member, shall be present at any meeting of the Society or committees, or be admitted at the Society's rooms, after having delivered in his claims, until such claims are adjudged, unless summoned by the committee.

A candidate for a premium, or a person applying for a bounty, being detected in any attempt to impose on the Society, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

The consideration of the claims for the premiums offered in the present list will take place during the session of the Society commencing on Wednesday the second of November, 1825. The several candidates and claimants, to whom the Society shall adjudge premiums or bounties, are to attend on the last Wednesday in May, or such other day as the Society shall appoint to receive the same; and before that time no premium or bounty will be delivered, except to those who are about to leave the kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, deputies may be substituted to receive the rewards, provided such deputies are either members of the Society, or superior officers thereof.

PREMIUMS IN AGRICULTURE.

N. B.—*The Winchester bushel is the measure referred to for grain; and, as the acres of different districts vary in extent, it is necessary to observe, that the Society mean statute acres of five and a half yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.*

I.—IMPROVEMENT OF LAND.

Gaining Land from the Sea.

1. To the person who shall have gained the greatest quantity of land from the sea, not less than one hundred acres, on the coast of Great Britain or Ireland;—*the Gold Medal.*

Certificates of the quantity of land, and that the experiments were begun after the 1st of January, 1820, to be produced to the Society on or before the first Tuesday in February, 1826.

Improving waste Land.

2. For an account of a method, superior to any hitherto practised, of improving land lying waste and uncultivated, verified by experiments on not less than fifty acres of land;—*the Gold Medal.*

3. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required that the land before such improvement, be absolutely uncultivated, and in a great measure useless; and that, in its improved state, it be inclosed and cultivated.

Certificates of the number of acres, of the quality of the land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced to the Society on or before the first Tuesday in February, 1826.

Laying down light Land to Permanent Grass.

4. To the person who shall ascertain, by actual experiment, the comparative merit of the following modes of laying down light soils to permanent grass, with a view to obtain a good sward in the shortest time, viz. by inoculating or transplanting, as recently practised in the county of Norfolk, either with or without corn; by sowing grass-seeds in the spring, in the common way, with corn, buckwheat, &c.; or by sowing grass-seeds alone in the autumn;—*the Gold Ceres Medal.*

It is required that every operation, and the expense of each mode, be fully described, with proper certificates of the soil and subsoil in each experiment being respectively of similar qualities, and of their having previously been similarly treated as to cultivation and manure, and of at least one acre having been tried under each system, to be produced to the Society on or before the last Tuesday in February, 1826.

Manures.

5. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following manures, used as top-dressings on grass and corn-land, viz. soot, coal-ashes, wood-ashes, lime, salt, bones, night-soil, or any other fit article;—*the Gold Medal.*

It is required that the above experiments be made between four of the above-mentioned manures, and that not less than two acres of land be dressed with each manure.

6. For similar comparative experiments on two or more kinds of manure;—*the Silver Medal.*

An account of the nature of the soil, the quantity and expense of the manure and crops, with certificates, to be produced on or before the last Tuesday in February 1826.

II.—PLANTATIONS.

Forest Trees.

7. To the person who shall have enclosed, and planted or set, the greatest number of acres (not less than one hundred) of land that is incapable of being ploughed, or otherwise unfit for tillage, with the best sorts of forest trees, namely, oak, Spanish chesnut, ash, elm, beech, alder, willow, larch, spruce or silver fir, (with or without screens of Scotch fir), adapted to the soil, and intended for timber trees, between the 1st of October, 1821, and the 1st of April, 1822; —*the Gold Medal.*

8. For the second greatest quantity of land, not less than fifty acres;—*the Silver Medal.*

A particular account of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after making the plantations, to be delivered to the Society on or before the second Tuesday in February, 1826.

N. B. With the above forest trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

Oaks, not transplanted.

9. For having set, in the season 1819-1820, the greatest quantity of land, not less than twenty acres, with acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

10. For the second greatest quantity of land, not less than ten acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young oaks, in good condition, on each acre, to be delivered to the Society on or before the first Tuesday in February, 1826.

Larch.

11. For having planted out, between June, 1822, and June, 1823, the greatest number of larch trees, not fewer than fifty thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

12. For the next greatest number, not fewer than thirty thousand;—*the Silver Medal.*

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the first Tuesday in February, 1826.

N. B. The larch trees may be planted either mixed with other trees or by themselves, as may best suit the convenience of the planter.

Norway Fir.

13. To the person who shall have raised, in the year 1825, the greatest number of plants from seed of Norway fir, imported from Norway;—*the Gold Medal.*

Certificates of the number of plants in a thriving state, not fewer than three thousand, to be produced to the Society, on or before the first Tuesday in February 1827, accompanied by a full description of the methods followed in making the plantation, the expense of the same, the nature of the soil, and the district in Norway from which the seed was imported.

14. To the person who shall have imported from Norway the greatest number, not less than two thousand, of Norway fir seedlings, and shall have planted the same during the year 1823, placing them at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be de-

livered to the Society on or before the first Tuesday in February, 1826.

N. B. It is recommended to plant seedlings of about three or four years' growth, and in a moderately good soil, somewhat sheltered. The wood from the district of Christiana is esteemed the best for carpenters' and joiners' use; and for spars and ufers the trees near to Long Sound are most valued.

Walnut Trees.

15. For having planted the greatest number of walnut trees, not less than two hundred, since June, 1823; and for having effectually fenced and preserved the same in order to raise timber;—*the Gold Medal.*

16. For the next greatest number, not fewer than one hundred; —*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants from each other, to be delivered to the Society on or before the first Tuesday in February, 1826.

Mulberry Trees.

17. To the person who shall have planted the greatest number of white mulberry trees, not less than one thousand, in the seasons 1823-4, and shall have effectually fenced the same;—*the Gold Ceres Medal.*

Certificates of having planted agreeably to the above conditions, the distance of the trees from each other, the nature of the soil and other particulars of management, whether the trees have been found to be affected by blights or by insects, and the state of the trees at the time of making the communication, to be delivered to the Society on or before the first Tuesday in February, 1826.

Securing Plantations.

18. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive method, better than any other generally known, of securing young plantations of timber trees, and hedge-rows, from hares and rabbits, as well as from sheep and cattle;—*the Gold Ceres Medal, or Thirty Guineas.*

The accounts and certificates of the efficacy of the method, to be produced to the Society on or before the first Tuesday in February, 1826.

III. COMPARATIVE EXPERIMENTS ON RAISING TREES.

Oaks.

19. To the person who shall have ascertained, by actual experiment, continued for five years at least, the comparative merits of the different modes of raising oaks for timber, from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on smooth surface, or among bushes, fern, or other cover; and from young plants raised in nurseries, and transplanted: regard being had to the expense, growth, and other respective advantages of the several methods;—*the Gold Medal.*

The accounts, and proper certificates that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in February, 1826.

Walnuts.

20. To the person who shall communicate to the Society an improved mode of propagating the superior varieties of walnuts, either by budding, grafting, or any other mode, except sowing;—*the Gold Medal.*

Certificates that not fewer than 50 trees have been so raised, with a full account of the method practised, to be produced to the Society on or before the first Tuesday in February, 1826.

IV.—CULTIVATION OF CORN AND OTHER PLANTS.

Wheat.

21. For the best set of experiments made on not less than twelve acres, four acres being sown broadcast, four drilled, and four dibbled, in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation, and the expense of each mode of culture, be fully described; and that proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the first Tuesday in January, 1826.

Grass Seeds.

22. To the person who shall raise the greatest quantity of each or any of the following named grass-seeds, viz.:—Meadow Foxtail (alopecurus pratensis), Sweet-scented Vernal-grass (anthoxanthum odoratum), Timothy-grass (phleum pratense), Meadow Fescue-grass (festuca pratensis), Smooth-stalked Meadow-grass (poa pratensis), Rough-stalked Meadow-grass (poa trivialis), Rough Cock's-foot (dactylis glomerata), Perennial Ray-grass (lolium perenne);—*the Silver Medal.*

It is required that certificates from persons that have viewed them in a proper state to identify that they are one or other of the seeds above mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds, or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first Tuesday of February, 1826.

Rye Grass.

23. To the person who shall produce to the Society a specimen of perennial rye grass (lolium perenne), being from stock originally of his own selection, which shall possess the properties of coming to a sward in less time than the varieties hitherto cultivated; and which shall be permanent, more abundant, of better quality, and as early as the most forward of the varieties usually sown;—*the Silver Medal.*

It is required that five pounds of the seed, and a specimen of an entire plant of the grass, be forwarded with the communication.

Certificates, of the candidate having cultivated the variety produced not less than six years, of his having, at the time of making the communication, at least ten acres sown with it, and of its superiority over other varieties of the same species, to be produced to the Society on or before the last Tuesday in February 1826.

Seed of the Grass employed in making Fine-Plat.

24. To the person who shall, in the year 1825, collect the greatest quantity of seed, not less than one hundred weight, from plants raised in Great Britain, of a species of Poa, a native of Connecticut in the United States, the stems of which are employed there as the material for fine plat, as described in the 40th volume of the Society's Transactions, and seeds of which have been imported and distributed by the Society;—*the Silver Medal, or Twenty Guineas.*

25. For the next greatest quantity, not less than five pounds, by persons not having previously obtained the Society's premium for this subject;—*the Silver Ceres Medal, or Ten Guineas.*

Satisfactory certificates, with a sample of the seed, and of the grass from which it was produced, to be sent to the Society on or before the first Tuesday in February, 1826.

Cultivation of Grass for Fine-Plat.

26. To the person who shall cultivate the greatest quantity of the above grass, not less than one acre, and shall send to the Society, on or before the last Tuesday in November, 1826, a particular account of the mode of cultivation, together with specimens, and certificates of the state of the plantation;—*the Gold Ceres Medal.*

Italian culture and treatment of Straw for Leghorn Plat.

27. To the person who shall procure, and communicate to the Society, a full account of the methods of cultivating and treating the straw in Italy, for the manufacture of Leghorn plat;—*the Gold Ceres Medal, or Thirty Guineas.*

The account, with specimens of the straw, to be delivered to the Society on or before the first Tuesday of March, 1826.

Beans.

28. To the person who shall discover, and cultivate for two successive years, a species of horse-beans, or tick-beans, which, being sown in the spring, will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that the experiment shall have been made each year on not less than five acres of land, that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the last Tuesday in November, 1826. It is apprehended that if a bean should be brought into cultivation with the habits of hotspur or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat.

Parsnips.

29. To the person who shall cultivate the greatest quantity of land, not less than five acres, with parsnips, for the particular purpose of feeding cattle or sheep;—*the Silver Medal.*

Certificates of the quantity of land so cultivated, with a particular account of the nature of the soil, and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the first Tuesday in February, 1826.

Preventing the rotting of Clover Plants.

30. To the person who shall communicate to the Society a satisfactory account of some method successfully employed in preventing the failure of clover crops, in consequence of the plants rotting on the ground, in the winter and spring, which they commonly do in patches, appearing to extend from a centre;—*the Gold Ceres Medal.*

Full particulars, and satisfactory certificates, to be produced to the Society on or before the second Tuesday in March, 1826.

The Society invite persons to communicate any information on this subject which may tend to discover the cause of the clover plant rotting, although they may not be able to point out an effectual mode of preventing the same.

Hemp.

31. To the person who, in the year 1825, shall have sown with hemp, either broad-cast or in drills at least 18 inches asunder, the greatest quantity of land, not less than fifty acres, and at the proper season shall have caused to be plucked the summer hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal.*

32. For the next greatest quantity, not less than twenty-five acres;—*the Silver Medal.*

Certificates of the number of acres, of the distance of the drills, of the plucking of the hemp, with a general account of the soil, cultivation and produce, to be delivered to the Society, along with fourteen pounds of the hemp and two quarts of the seed, on or before the last Tuesday in February, 1826.

Cultivation of the White Poppy (papaver somniferum), and extraction of the Opium.

33. To the person who shall prepare the greatest quantity of opium, not less than 250 lbs., from the white poppy (papaver somniferum), raised by the claimant, in Great Britain or Ireland, in the year 1825;—*the Gold Medal.*

34. To the person who shall obtain the next greatest quantity, not less than 120 lbs., raised by the claimant as above, he not having previously obtained the Society's premium;—*the Gold Ceres Medal, or Thirty Guineas.*

Certificates of the quantity and quality of the produce, with specimens, and a full description of the mode of culture, and of the extraction and preparation of the opium, to be sent to the Society on or before the first Tuesday in February, 1826.

Persons proposing to claim the above premium, are referred to Mr. Young's communications on the subject, in the 37th and 38th volumes of the Society's Transactions; to those by Messrs. Cowley and Staines, in the 40th, 41st, and 42nd volumes; and to one by Mr. Jeston, in the 41st volume.

Cultivation of the Phormium Tenax, or New Zealand Flax.

35. To the person who, in any part of Great Britain or Ireland, shall plant the greatest quantity of land, not less than one acre, with the phormium tenax, or New Zealand flax;—*the Gold Ceres Medal, or Thirty Guineas.*

A full account of the soil and exposure, the mode of cultivation, the distance between the plants, at least a dozen of the longest leaves, with certificates that the plants have stood three winters in the open air, to be produced to the Society on or before the first Tuesday in March, 1826.

This premium is continued one year further, on the same conditions.

The plant is perennial, is propagated by off-sets, and the flax is prepared from the fibres of the leaves. It has been cultivated as an ornamental plant in the open air, for several years, in the vicinity of Dublin, and in various parts of the south of Ireland; also in South Wales, and in Devonshire. For a farther account of it, see Mr. Salisbury's communication in the 42d volume of the Society's Transactions.

Preserving Cabbages.

36. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle, during the months of February, March, and April;—*the Silver Medal.*

A full and accurate account of the method employed, and of the expense, together with certificates that the produce of four acres has been so preserved, and applied to feeding sheep or cattle, to be produced to the Society on or before the last Tuesday in April, 1826.

Harvesting Corn in wet Seasons.

37. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of harvesting corn in wet seasons;—*the Gold Medal.*

A full account of the method employed, and of the expense attending the process, with not less than two sheaves of the corn, and certificates that, at the least, the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples, to be produced to the Society on or before the first Tuesday in February, 1826.

VI. DESTROYING INSECTS AND OTHER VERMIN.

Destroying the Grub of the Cock-Chafer, &c.

38. To the person who shall discover to the Society an effectual method, verified by repeated and satisfactory trials, of destroying the grub of the cock-chafer, the wire-worm, or the slug, or of preventing or checking their destructive ravages on corn, peas, beans, and turnips;—*the Gold Medal.*

The accounts, with proper certificates, to be produced on or before the first Tuesday in February, 1826.

Destroying the Fly on Hops.

39. To the person who shall discover to the Society an easy and efficacious method of destroying the fly on hops, superior to any hitherto known;—*the Gold Medal.*

Accounts and certificates of the method having been successfully practised on not less than four acres of hop-ground, to be delivered to the Society on or before the first Tuesday in February, 1826.

Destroying the Fly on Turnips.

40. To the person who shall discover to the Society an easy and efficacious method of destroying the fly on turnips, or of preventing its injurious effect on the crop;—*the Gold Medal.*

Conditions the same as for the preceeding premium.

Preventing the blight on Fruit Trees and Culinary Plants.

41. To the person who shall discover to the Society the most effectual method of preventing the blight, or ravages of insects, on fruit trees and culinary plants, superior to any hitherto known or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

The accounts, with proper certificates, to be delivered to the Society on or before the first Tuesday in February, 1826.

VII.—CATTLE AND SHEEP.

Feeding Cattle.

42. To the person who shall have made the best experiments on feeding cattle, to be continued for the space of twelve months, in order to prove the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain or Ireland, the experiments to be made on three different breeds, and on two head of cattle of each breed;—*the Gold Medal.*

A full account of the methods employed, the ages of the animals, the kind and quality of the food, the weights of them at the commencement and termination of the experiment, the expense attending the same, and such other observations as may be deemed important, together with certificates, to be produced to the Society on or before the first Tuesday in February, 1826.

43. To the person who shall have made the best experiments on the comparative value of mangel-wurzel and Sweedish turnips for fatting cattle, ascertained by feeding not less than three head of cattle upon each kind of food;—*the Gold Ceres Medal.*

A particular account is required of the quality of the soil and subsoil, exposure, and mode of culture, produce per acre, and weight per diem of each kind of root consumed; also whether any, and what, other kind of food is given.

The communication, with certificates as to the condition of the cattle at the commencement and termination of the experiment, to be produced to the Society on or before the last Tuesday in February, 1826.

Milch Cows.

44. To the person who shall have made the most satisfactory experiments on the comparative value of mangel-wurzel and Swe-

dish turnips for feeding milch cows, ascertained by keeping not less than three cows on each kind of food;—*the Gold Ceres Medal.*

A particular account of the quality of the soil and subsoil, expense and mode of culture, produce per acre, and weight per diem of each kind or root consumed, also whether any, and what, other kind of food has been given, accompanied by certificates of the quantity and quality of the milk obtained, of the proportion of cream from a given quantity of the milk, and of butter from a given quantity of the cream, to be produced to the Society on or before the first Tuesday in March, 1826.

Protecting Sheep.

45. To the person who shall practise and communicate to the Society the best and cheapest method of protecting large flocks of sheep, not less than five hundred, from the inclemency of the weather during the winter months, particularly in mountainous districts, where the practice of protecting sheep has not hitherto been adopted;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society on or before the first Tuesday in March, 1826.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time, together with the general method of managing them.

Cachemire-shawl Goat.

46. To the person who shall have kept in a healthy state, in any part of the United Kingdom, during the last three years preceeding the first of February, 1826, the greatest number of Cachemire-shawl goats;—*the Gold Medal.*

Certificates that at least five goats are in good health at the time of making the communication, together with full particulars of the method of treating them, to be produced to the Society on or before the first Tuesday in March, 1826.

Cure of the Rot in Sheep.

47. To the person who shall discover to the Society the best and most effectual method of curing the rot in sheep, verified by repeated and satisfactory experiments;—*the Gold Medal, or Fifty Guineas.*

It is expected that the candidate furnish accurate accounts of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper certificates, must be delivered to the Society on or before the last Tuesday in February, 1826.

Preventing the ill effects of Flies on Sheep.

48. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies;—*the Silver Medal, or Ten Guineas.*

It is required that the method be ascertained by repeated experiments, and that a certificate of its efficacy be delivered to the Society on or before the first Tuesday in February, 1826.

VIII. AGRICULTURAL MACHINES.

Irrigation of Land.

49. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land, superior to and cheaper than any other method now in use;—*the Gold Medal, or Fifty Guineas.*

A model, on a scale of one inch to a foot, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it is raised, to be produced to the Society on or before the first Tuesday in March, 1826.

Paring Plough.

50. To the person who shall

invent and produce to the Society a machine or plough, for the purpose of paring land preparatory to burning, superior to any hitherto known or in use for such purpose; —*the Silver Medal, or Twenty Guineas*

The machine, and certificates that at least ten acres have been pared by it in a proper manner, to be produced to the Society on or before the first Tuesday in February, 1826.

Thrashing Machine.

51. To the person who shall invent a machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at less expense than by any method now in use, and without injuring the straw more than thrashing by the flail;—*the Gold Medal.*

The machine, or model, with proper certificates that such a machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation, to be produced to the Society on or before the last Tuesday in February, 1826.

PREMIUMS IN CHEMISTRY, DYEING, AND MINERALOGY.

Increasing Steam.

52. To the person who shall invent and discover to the Society a method, verified by actual experiment, of increasing the quantity or force of steam in steam engines, with less fuel than has hitherto been employed, provided that in general the risk of accidents be not increased, and the whole amount of the expenses in using steam engines be considerably lessened;—*the Gold Medal, or Fifty Guineas.*

To be communicated to the Society on or before the last Tuesday in February, 1826.

Prevention of Smoke.

53. To the person who shall invent and produce to the Society the best and easiest means, superior to any now before the public, of preventing the emission of dense smoke, from the chimnies of steam-engines, breweries, and manufactories;—*the Gold Medal, or Fifty Guineas.*

Certificates that the means proposed have been found to succeed in practice, to be produced to the Society on or before the first Tuesday in February, 1826.

Test for Arsenic.

54. To the person who shall discover to the Society a test for arsenic in solution, superior to any hitherto known;—*the Gold Medal.*

It is required, that any communication in claim of this premium shall include a method of detecting arsenic, not only in its usual form of white arsenic, or arsenious acid, but also in the state of arsenic acid, and of the soluble salts formed by the combination of arsenious and arsenic acids with alkaline substances.

Claims for this premium to be delivered in on or before the first Tuesday in February, 1826.

Preventing the ill effects of Smelting Ores.

55. To the person who shall invent and discover to the Society the most effectual method of preventing the ill effects arising to vegetation and animal life, from the sulphureous, arsenical or other noxious fumes disengaged in smelt-

ing the ores of copper, zinc, lead, tin, iron, &c. in the large way; and, if possible, of converting those pernicious fumes to useful purposes, in a manner superior to any hitherto known or in use;—*the Gold Medal, or Fifty Guineas.*

It is required that a full account of the process employed, with certificates of its being successfully carried into effect, be produced to the Society on or before the first Tuesday in February, 1826.

Fine Bar-Iron.

56. To the person who shall make the greatest quantity of bar-iron, not less than ten tons, with coke, from coke pigs, equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal, or Fifty Guineas.*

Samples, not less than one quarter of a hundred weight, with certificates that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in February, 1826.

Refining Copper from the Ore.

57. To the person who shall discover to the Society a method of separating, purifying, and refining copper from the ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than, and superior to, any hitherto known or in use;—*the Gold Medal, or Fifty Guineas.*

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than 14 lbs. of the copper so refined, to be produced to the Society on or before the first Tuesday in February, 1826.

Refining Zinc from the Ore.

58. To the person who shall invent and communicate to the Society a process of refining zinc from the ore, superior to any hitherto known or in use, and fit for the purpose of making fine brass;—*the Gold Medal, or Fifty Guineas.*

Conditions the same as in the preceding premium.

Preparing Brass.

59. To the person who shall discover a method of making brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country, and equal to foreign brass;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured, and a sample of the brass, not less than 14 lbs. to be produced to the Society on or before the first Tuesday in February, 1826.

Improved Earthenware Crucibles.

60. To the person who shall invent and discover to the Society a process for manufacturing earthenware crucibles which shall not be liable to crack in the fire, and shall be capable of enduring the action of fluxes, and higher degrees of heat than those now in use, and shall not be too expensive;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process, and of the materials employed, with satisfactory certificates of the crucibles having been found to answer in use, and specimens of the crucibles, with covers of the same material, to be produced to the Society on or before the first Tuesday in February, 1826.

Improved melting Pots.

61. To the person who shall invent and produce to the Society a process for manufacturing melting pots, for founders in brass, iron, and other metals, superior to those now in use, and not too expensive;—*the Gold Vulcan Medal, or Thirty Guineas.*

Conditions the same as for the preceding premium.

Purification of Coal Gas.

62. To the person who shall

discover the cheapest method of purifying the inflammable gas procured from coal, superior to any method now in use;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process, with certificates of its fully answering the intended purpose, to be produced to the Society on or before the second Tuesday in February, 1826.

Refining Whale or Seal Oil.

63. To the person who shall invent and discover to the Society an effectual method of purifying whale or seal oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; provided that such purified oil resists congelation in an equal degree with the unpurified;—*the Gold Medal, or Fifty Guineas.*

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society, to determine the validity of the claim; and certificates that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil in its unpurified state, and two gallons so refined, to be produced to the Society on or before the second Tuesday in February, 1826.

Oil for Chronometers.

64. To the person who shall invent and discover to the Society a method, verified by actual experiment, of rendering oil more fit than any now in use for chronometers and watches, particularly in being less liable to become thick or rancid;—*the Gold Medal, or Fifty Guineas.*

A full account of the experiments, and of the process or processes employed, verified by satisfactory certificates, together with a specimen of the oil, to be produced to the Society on or before the last Tuesday in March, 1826.

Crown Glass.

65. To the person who shall make crown or window glass equally transparent, and as free from blue and green colour, as the best German sheet;—*the Gold Vulcan Medal, or Thirty Guineas.*

Certificates that not less than two cwt. have been made, together with one whole plate and two of the largest squares that can be cut, and a full account of the proportions of the ingredients, and of the process of manufacture, to be produced to the Society on or before the last Tuesday in February, 1826.

Flint Glass.

66. To the person who shall make flint glass free from veins, as dense and transparent as the best now in use, and quite fit for the purposes of opticians;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, with certificates that not less than 20 lbs. have been made, and that object glasses, at least three and a half inches in diameter, have been manufactured of the same, together with specimens of the glass in its rough and manufactured state, to be produced to the Society on or before the last Tuesday in January, 1826.

Indelible Ink.

67. To the person who shall discover to the Society a method of making a black ink proper for writing, superior to any at present known, indestructible by chemical applications, and not too dear for common use;—*the Silver Medal, or Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities above-mentioned, with a full detail of the process of making it, and two quarts of the ink, to be delivered to the Society, on or before the second Tuesday in February, 1826.

Printers' Ink.

68. To the person who shall invent and discover to the Society the best composition for printers' ink, superior to any hitherto known or in use;—*the Gold Medal, or Thirty Guineas*

Certificates that 112 lbs. of such ink have been made, with a full account of the process employed, and 6 lbs. of the ink, to be produced to the Society on or before the first Tuesday in February, 1826.

Copper-Plate Printers' Ink.

69. To the person who shall invent and discover to the Society the best composition for printers' ink, superior to any hitherto known or in use, and fit for the finest kind of copper-plate printing;—*the Gold Medal, or Thirty Guineas.*

Certificates and conditions the same as for the last premium.

Rendering Leather Water-proof.

70. To the person who shall discover a method, superior to any now in use, and of moderate price, of rendering leather water-proof, without injuring its texture or pliability;—*the Silver Medal, or Fifteen Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the leather in its unprepared and prepared state, to be produced to the Society on or before the first Tuesday in February, 1826.

Preserving Seeds of Vegetables.

71. For the best method of preserving seeds of plants, during a long sea voyage, in a state fit for vegetation, a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the last Tuesday in February, 1826;—*the Gold Medal, or Thirty Guineas.*

Preserving Provisions from becoming Rancid or Rusty.

72. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving salted provisions from becoming rancid or rusty;—*the Gold Medal, or Thirty Guineas.*

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the last Tuesday in February, 1826.

Preserving Iron from Rust.

73. To the person who shall invent and discover to the Society a cheap composition, superior to any now in use, which shall effectually preserve wrought iron from rust;—*the Gold Medal, or Fifty Guineas.*

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with one pound weight of the composition, on or before the last Tuesday in January, 1826.

Preventing the Dry Rot in Timber.

74. To the person who shall discover to the Society a certain method of preventing the dry rot in timber, superior to any hitherto known;—*the Gold Medal, or Fifty Guineas.*

The particulars of the method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the last Tuesday in February, 1826.

Preventing the Mildew in Paper or Canvas.

75. To the person who shall communicate to the Society a process to be used in the manufacture of paper or canvas, or some application to be made to manufactured paper or canvas, which shall effectually prevent it from becoming mildewed;—*the Gold Medal, or Fifty Guineas.*

A full account of the process employed, with certificates and other evidence of its efficacy, to be communicated to the Society on or before the last Tuesday in February, 1826.

Preventing the destructive Effects from Moths.

76. To the person who shall discover to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal, or Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in January, 1826.

Substitute for Lead Pipes.

77. To the person who shall invent and produce to the Society a substitute for the lead pipes used for conveying malt and other liquors from the cellars to the bars of public-houses, superior to any other metal pipes now in use;—*the Gold Medal, or Fifty Guineas.*

The substance of which the pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and of a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society on or before the last Tuesday in February, 1826.

Substitute for the Basis of White Paint for Oil Colours.

78. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of white paint for oil colours, equally proper for the purpose as the white lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white lead;—*the Gold Medal, or Fifty Guineas.*

A quantity of the substitute, not less than 10 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in February, 1826.

Substitute for Tar.

79. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of the United Kingdom, or its colonies;—*the Gold Medal, or One Hundred Guineas.*

A quantity of the substitute, not less than 25 lbs., with certificates that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an account of the process, to be delivered to the Society on or before the first Tuesday in February, 1826.

Dyeing Silk of a Pink or Rose Colour.

80. To the person who shall invent and discover to the Society a process of dyeing rose and pink colours in silks, without the use of safflower, by a substitute of British or colonial growth, which shall produce a colour equally beautiful and permanent, and at an expense not more than two-thirds of the current price;—*the Gold Medal, or Forty Guineas.*

The communication, with a full account of the processes employed, and certificates that the required conditions are accomplished, to be produced to the Society on or before the first Tuesday in February, 1826.

Improved Black Dye for Silk or Wool.

81. To the person who shall invent and discover to the Society a black dye for silk or wool, superior in colour and durability to any at present in use;—*the Gold Medal, or Fifty Guineas.*

This premium is more immediately intended for the improvement of those co-

lours known by the name of blue blacks.

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk or wool so dyed, to be produced to the Society on or before the first Tuesday in February, 1826.

Dyeing with Lac Lake, or with the Colouring Matter of Lac.

82. To the person who shall invent and discover to the Society a process for dyeing silk, wool, or cotton with lac lake, or with the colouring matter of lac, superior to any now in use;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, with certificates that it has been found to answer completely in use, and specimens of articles so dyed, to be produced to the Society on or before the first Tuesday in February, 1826.

Preparation of a Red Stain for Cotton Cloth.

83. To the person who shall communicate to the Society the most effectual method of printing or staining cotton cloth with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal, or Fifty Guineas.*

Certificates that the process has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, one pound of the colour, and a full account of the preparation and application thereof, to be produced to the Society on or before the second Tuesday in February, 1826.

Preparation of a Green Colour for Printing Cotton Cloth.

84. To the person who shall communicate to the Society the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions of indigo;—*the Gold Medal, or Fifty Guineas.*

Certificates and conditions as for premium 83.

Permanent White Paint for the use of Artists.

85. To the person who shall produce to the Society a white paint for oil, superior to any hitherto known, and not liable to be discoloured by exposure to light, or to sulphuretted hydrogen gas;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, and 1 lb. of the colour, to be produced to the Society on or before the second Tuesday in February, 1826.

Red Pigment.

86. To the person who shall discover to the Society a full and satisfactory process for preparing a red pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal, or Fifty Guineas.*

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1826.

N. B. It is required, that the colour should remain unaltered by common exposure to strong light, damps, and noxious vapours.

Blue Pigment.

87. To the person who shall prepare a blue pigment, equal in colour, brilliancy, and durability, to the best ultramarine prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal, or Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

Colourless Lac Varnish.

88. To the person who shall produce to the Society a varnish made from shell or seed lac, equally hard and as fit for use in the arts as that at present prepared from the above substances, but deprived of its colouring matter; —*the Gold Medal, or Thirty Guineas.*

A full account of the process, and one quart of the varnish, to be produced to the Society on or before the second Tuesday in January, 1826.

Stone for Lithography.

89. To the person who shall discover within Great Britain or Ireland, a quarry of stone fit for the purposes of lithography, equal at least to the stones imported from abroad;—*the Gold Medal, or Fifty Guineas.*

A specimen of the stone, at least two feet square and two inches in thickness, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the last Tuesday in February, 1826.

90. To the person who shall discover and communicate to the Society any substance equally fit for the purposes of lithography with the best stones imported from abroad;—*the Gold Isis Medal, or Thirty Guineas.*

A full description of the process of preparing or composing the substance, with specimens thereof, to be produced to the Society on or before the first Tuesday in February, 1826.

Mineralogical and Geological County Maps.

91. To the person who shall complete and publish the best mineralogical and geological map of any county in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced, with sections of the strata;—*the Gold Medal, or Fifty Guineas.*

The map, with certificates of its accuracy, to be produced to the Society on or before the first Tuesday in February, 1826. One impression of the map to remain the property of the Society.

Mineralogical and Geological Map of Ireland.

92. To the person who shall complete and publish an accurate mineralogical and geological map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal, or Fifty Guineas.*

The conditions are the same as in the preceding.

Mineralogical and Geological Map of Scotland.

93. The same premium is offered for a mineralogical and geological map of Scotland, on similar conditions.

PREMIUMS IN POLITE ARTS.

HONORARY PREMIUMS FOR NOBILITY.

To GENTLEMEN *under the age of twenty-five, Sons or Grandsons of Peers or of Peeresses in their own right in the United Kingdom.*

94. For the best original paint-

ing or drawing of an historical subject;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

95. For the best copy of an historical subject; — *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

96. For the best original painting or drawing of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

97. For the best copy of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

98. For the best original painting or drawing of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

99. For the best copy of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

100. For the best original painting of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

101. For the best copy of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

102. For the best original painting of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

103. For the best copy of still-life;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To LADIES *under the age of twenty-five, daughters or grand-daughters of Peers or Peeresses in their own right of the United Kingdom.*

104. For the best original painting or drawing of an historical subject;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

105. For the best copy of an historical subject; — *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

106. For the best original painting or drawing of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

107. For the best copy of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

108. For the best original painting or drawing of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

109. For the best copy of a landscape; — *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

110. For the best original painting of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

111. For the best copy of flowers or fruit;—*the Silver Medal,* For the next in merit, *the Silver Isis Medal.*

112. For the best original painting of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

113. For the best copy of still-life;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

HONORARY PREMIUMS FOR GENTLEMEN AND LADIES.

To GENTLEMEN *under the age of eighteen.*

114. For the best drawing in chalk, pencil or Indian ink, being a copy from any picture, print, or

drawing of a head or figure;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

115. For the best drawing in pencil, Indian ink, or chalk, of a landscape, being a copy;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

To GENTLEMEN *under the age of twenty.*

116. For the best drawing in chalk, pencil, or Indian ink, from a bust;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To GENTLEMEN *under the age of twenty-one.*

Drawings and Paintings in Water-Colours.

117. For the best drawing in chalk, pencil, or Indian ink, from a statue or cast in plaster, of an entire figure;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

118. For the best drawing in pencil, Indian ink, or chalk, of an historical subject, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

119. For the best painting in water-colours, of an historical subject, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

120. For the best painting in water-colours of a portrait, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

121. For the best painting in water-colours of a landscape, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

122. For the best painting in water-colours of flowers or fruit, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Paintings in Oil.

123. For the best copy in oil-colours of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

124. For the best copy in oil-colours of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

125. For the best copy in oil-colours of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

126. For the best copy in oil-colours of flowers or fruit;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To GENTLEMEN *under the age of twenty-five.*

Drawings and Paintings in Water-Colours.

127. For the best original painting in water-colours of an historical subject;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

128. For the best original painting in water-colours of a portrait, being a miniature;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

129. For the best original painting in water-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

130. For the best original painting in water-colours of flowers or fruit;—*the Gold Isis Medal.* For

the next in merit, *the Silver Medal.*

Paintings in Oil.

131. For the best original painting in oil-colours of an historical subject, consisting of not less than three figures;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

132. For the best original painting in oil-colours of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

133. For the best original painting in oil-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

134. For the best original painting in oil-colours of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

135. For the best original painting in oil-colours of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

To Ladies under the age of eighteen.

136. For the best drawing in pencil, Indian ink, or chalk, being a copy from any picture, print, or drawing, of a head or figure;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

137. For the best drawing in pencil, Indian ink, or chalk, of a landscape, being a copy;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

To Ladies under the age of twenty.

138. For the best drawing in pencil, Indian ink, or chalk, from a bust;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To Ladies under the age of twenty-one.

Drawings and Paintings in Water-Colours.

139. For the best drawing in pencil, Indian ink, or chalk, from a statue or cast in plaster, of an entire figure;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

140. For the best drawing in pencil, Indian ink, or chalk, being a copy, of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

141. For the best painting in water-colours, being a copy, of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

142. For the best painting in water-colours of a portrait, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

143. For the best painting in water-colours of a landscape, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

144. For the best painting in water-colours, being a copy, of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Paintings in Oil.

145. For the best copy in oil-colours of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

146. For the best copy in oil-colours of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

147. For the best copy in oil-colours of a landscape;—*the Sil-*

ver Medal. For the next in merit, *the Silver Isis Medal.*

148. For the best copy in oil-colours of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To LADIES *under the age of twenty-five.*

Drawings and Paintings in Water-Colours.

149. For the best original painting in water-colours of an historical subject;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

150. For the best painting of a portrait in water-colours, being a miniature;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

151. For the best original painting in water-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

152. For the best original painting in water-colours of fruit or flowers;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Paintings in Oil.

153. For the best original painting in oil-colours of an historical subject, consisting of not less than three figures;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

154. For the best original painting in oil-colours of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

155. For the best original painting in oil-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

156. For the best original painting in oil-colours of fruit or flowers;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

157. For the best original painting in oil-colours of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

N. B. As the foregoing honorary premiums are intended only for the nobility and gentry, persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admitted candidates in the above classes.

PREMIUMS FOR ARTISTS AND OTHERS.

Human Figure.

158. For the best drawing in chalk, pencil, or Indian ink, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

159. For the best outline, drawn from any entire figure of the antique, or cast in plaster, the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under the age of eighteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

160. For the best drawing from any entire antique figure, or from any cast in plaster, the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

161. For the best outline drawing of an entire anatomical human figure, from a model or cast, the size of the drawing to be not less

than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under ths age of nineteen; —*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

162. For the best drawing from the living figure, the size of the drawing to be not less than twenty-four inches, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

163. For the best copy in water-colours from any picture, being a composition of two or more figures, the size of the principal figure not less than nine inches, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

164. For the best original drawing, being a composition of two or more figures, the principal figure not less than nine inches, by persons under the age of twenty-five; —*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

165. For the best copy in oil from any picture, being a composition of two or more figures, the principal figure not less than twenty-four inches, by persons under the age of twenty one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

166. For the best original painting in oil, being an historical composition, of not less than three figures, the principal figure not less than twenty-four inches high, and the size of the canvass to be a common half-length (or three feet four inches by four feet two inches); the subject *Saul and the Witch of Endor*, by persons under the age of twenty-five;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

167. For the best original painting in oil, being an historical or poetical composition, of not less than three figures, the principal figure not less than twenty-four inches high; the size of the canvass to be a common half-length (or three feet four inches by four feet two inches) by persons under the age of twenty-five;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Heads or Portraits.

168. For the best drawing of a head, copied from any picture, drawing, or print, by persons under the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

169. For the best finished drawing of a head, not less than the size of life, from any bust, by persons under the age of eighteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

170. For the best painting in oil, from an antique bust or cast, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis medal.*

171. For the best original painting in water-colours of a portrait, or group of portraits, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

172. For the best portrait in miniature, in water-colours, being a copy, by persons under the age of twenty;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

173. For the best original portrait in miniature, in water-colours, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

174. For the best copy in oil, of a portrait, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

175. For the best original painting in oil of a portrait, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Models.

176. For the best model in bass-relief, from any entire antique figure or cast in plaster, the size of the model not less than twenty-four inches, by persons under the age of eighteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

177. For the best model in bass-relief, from the living figure, by persons under the age of twenty-one, the model not less than twenty-four inches;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

178. For the best model of a bust from the antique, of a different size from the original, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

179. For the best model of a bust from nature, of the size of life, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

180. For the best model in the round, from an entire antique figure, the model not less than twenty-four inches high, by persons under the age of twenty-one; *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

181. For the best original model of a single figure, not less than twenty-four inches high, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

182. For the best original model of a group, the subject, *Sampson slaying the Philistines,* the figures not less than twenty-four inches, by persons under the age of twenty-five;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Landscape.

183. For the best drawing of a landscape, copied from any picture, drawing, or print, by persons under the age of eighteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

184. For the best original drawing of a landscape from nature, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

185. For the best original oil painting of a landscape from nature, by persons under the age of twenty-three;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

186. For the best original composition of a landscape painted in oil, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

187. For the best original marine painting, in oil, of two or more vessels, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Flowers or Fruit.

188. For the best painting in water-colours, by persons under

the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

189. For the best original composition in water-colours, from nature, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

190. For the best original composition in oil, painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Animals.

191. For the best drawing of one or more animals, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

192. For the best original drawing from nature, of one or more animals, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

103. For the best original painting in oil, of a group of not less than three animals, painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Still-life.

194. For the best original composition, painted in oil, or water-colours, of three or more such subjects as are usually called still-life, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Vignette.

195. For the best design for a vignette to be printed at the head of the Society's letters, &c;—*the Gold Medal.*

The design to remain the property of the Society.

Architecture.

Claims for the architectural premiums are to be sent in to the Society on or before the third Tuesday in January, 1826.

196. For the best drawing in perspective from a Corinthian capital, not less than eighteen inches high, by persons under twenty-one years of age;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

197. For the best design for a building, to contain national galleries of painting and sculpture;—*the Gold Medallion.* For the next in merit, *the Silver Medal.*

The following inscription to be engraved on the medallion; "*The premium given by the Society for the encouragement of Arts, Manufactures, and Commerce, in conformity to the will of John Stock, Esq., of Hampstead.*"

The drawings sent in for this premium to consist of one or more plans, elevations, and perspective views, with separate representations of such parts as may be necessary to give a complete explanation of the design. The drawings to be made on a scale of one-eighth of an inch to a foot; the perspective view, and the particular parts, on a larger scale if necessary. Particular attention will be required to be made, of lighting the galleries.

198. For the best design in Greek architecture of a building adapted to public meetings in the metropolis, to consist of plan, elevation, and perspective view, on a scale of one-eighth of an inch to a foot, by persons under the age of thirty;—*the Gold Isis Medal.*

199. For the best perspective drawing of any public building in the United Kingdom, from actual elevations taken by measurement, and projected according to

rule, drawn on large elephant paper, by persons under the age of twenty one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Drawings of Machinery.

200. For the best perspective drawing of machinery, by persons under the age of twenty-one; *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Enamel Painting.

201. For the best enamel painting of a head, by persons under the age of twenty-one; *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

202. For the best historical painting in enamel, by persons under the age of twenty-five; *the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Carving in Wood.

203. For the best carving in wood of fruit or flowers, not less than nine inches high, by persons under the age of twenty-one; *the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

204. For the best carving in wood, of one or more animals, the size of the animal not less than eight inches, by persons under the age of twenty-three;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

205. For the best carving in wood, of one or more human figures, not less than a foot in height, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

206. For the best carving in wood, of any enriched border or ornamental design;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Etching.

207. For the best free etching in historical composition, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

208. For the best free etching of a landscape, by persons under the age of twenty-five;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Finished Engravings on Steel or Copper.

209. For the best finished engraving in historical composition, by persons under the age of thirty;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

210. For the best finished engraving of a landscape, by persons under the age of thirty;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

211. For the best finished engraving of a portrait, by persons under the age of thirty;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

212. For the best finished engraving on steel, in mezzotinto;—*the Gold Isis Medal.*

N. B. In the class of finished engravings the Society require an aquifortis impression, and a finished proof, to be sent, and to remain with the Society.

Engraving on Blocks.

213. For the best engraving on wood or metal blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the block, to be produced to the Society. The

impressions, but not the block, to remain the property of the Society.

Lithography.

214. For the best specimens in this art;—*the Gold Isis Medal.*

The specimen to remain the property of the Society.

215. For the best account of the process employed in lithography superior to any hitherto known to the public;—*the Gold Isis Medal, or Thirty Guineas.*

The particulars of the process, accompanied by specimens of the art, and of the materials employed, with all other necessary information, to be produced to the Society on or before the first Tuesday in March, 1826.

216. For the best method of transferring drawings from the paper to the stone, for the purpose of lithography, superior to any hitherto in use;—*the Silver Medal, or Twenty Guineas.*

A complete account of the process employed, with specimens of the materials, to be produced to the Society.—Two specimens of the impression to remain with the Society.

Medal Die Engravings.

217. For the best die engraving either of a head or single figure, after the engraver's own design or model, by persons under the age of twenty-one;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

218. For the best die engraving of a group, after the engraver's own design and model, by persons under the age of thirty;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

The dies with two impressions or casts, and the model, in each claim for medal die sinking, are to be produced to the Society, and the impressions or casts to remain the property of the Society.

219. To the person who shall discover and communicate to the Society a method of making and hardening medal dies, superior to any hitherto known, and which shall prevent the surface of the die from being cracked, scaled, warped, or otherwise injured;—*the Gold Medal, or Thirty Guineas.*

A full and detailed account of all the processes required to produce the effect, with certificates of their successful application, to be delivered to the Society.

Gem Engraving.

220. For the best engraving in intaglio, of a head or single figure, on carnelian or other hard stone, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

221. For the best engraving in intagilo of a head or figure, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

222. For the best engraving in intaglio of a group, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

223. For the best engraving in cameo of a head or single figure, in carnelian or other hard stone, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

224. For the best engraving in cameo of a head or figure, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

225. For the best engraving in cameo of a group, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Premiums for Medical or Surgical Students.

226. For the best coloured anatomical model of a dissected limb, or other part of the human body, or morbid, in wax or other substance;—*the Gold Medal.*

227. For the best original drawing (made from actual dissection) of the anatomy of the human body, or of any part thereof, sufficiently full and accurate for the purposes of surgery, such drawing to be not less than the natural size of the parts, by persons under the age of twenty-five;—*the Silver Medal.* For the next in merit, *the Silver Iris Medal.*

It is required that each model and drawing be accompanied by an outline, with the necessary references to render them intelligible.

Conditions for the Polite Arts.

All performances in the class of polite arts, except those relating to architectural subjects, are to be produced to the Society on or before the first Tuesday in March, 1826, and none can be received after that day.

No candidate, under any pretence whatever, shall be allowed to retouch or varnish a performance after it has been received by the Society.

No candidate having received a premium or bounty, shall receive an equal reward in the same class or an inferior reward in any class of the same department of art.

No more than one performance in each class shall be received from the same candidate.

No candidate shall receive more than one premium or bounty in the same year.

All performances to which premiums or bounties are adjudged, shall remain with the Society until after the second Wednesday in June, 1826, when they will be redelivered, unless mentioned in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

All performances must have been executed within the year previous to their being sent in to the Society, except the finished engravings on steel and copper, which must have been executed within two years.

No performance can be received which does not come into one of the foregoing classes, and which does not agree with the conditions of the class in which it is introduced, except by a particular recommendation from the committee, and confirmed by the Society, that it is deserving of being made an exception to the general rule, and in such case a bounty may be given.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the candidates affix on the front of their performances whatever mark they please, each performance having a different mark; and that the same mark be inscribed on the outside of a paper sealed up, containing within, the name and residence of the candidate, and *on the outside*, the sex, and age, and the number of the premium in claim of which the performance is offered, and whether the candidate has previously received from the Society any and what reward; the name not to be disclosed unless the candidate be successful, or in consequence of a special vote of the Society, or Committee.

If a person is a candidate in more than one class a separate letter must be sent in with each performance.

To prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the candidate, the Society require a specimen of the abilities of each successful candidate to be made under the inspection of the committee of polite arts.

All copies are to be on a different scale from the original; and, if possible, the original is to be sent with the copy.

The Society reserve to themselves the power of giving medals of less value than those proposed; or of withholding them altogether in cases where the performance shall be deemed undeserving of reward. But if there should be in the same class more than two works of merit, deserving encouragement, the committee is allowed to recommend at the same time to the Society that a bounty be given; and in case of the second premium offered being the lowest reward which the Society gives, such lowest reward may be repeated as a bounty.

In consideration of the great number of premiums here offered, embracing so many departments of the fine arts, no bounty can be given, except by a special recommendation in cases of extraordinary merit; the reason of such recommendation to be particularly stated in the report of the committee.

PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

Fine Wool.

228. To the person who shall have produced from his own flock, in the year 1824, the greatest quantity, not less than 5 cwt. of wool equal to the Spanish merino, and as fit for the purpose of being manufactured into superfine cloth; —*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it, to be produced to the Society on or before the first Tuesday in February, 1826.

229. For the next greatest quantity, not less than two hundred and fifty pounds:—*the Silver Medal,* on similar conditions.

Transparent Paper.

230. To the person who shall discover to the Society a method of making transparent paper, better than any hitherto in use, and that shall take and bear common writing-ink with the same facility and correctness as writing paper; —*the Silver Medal, or Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced to the Society on or before the second Tuesday in February, 1826.—[China-Paper, see premium 293.]

Leather for Gloves.

231. To the person who shall make known to the Society a process equal or superior to that of the French, for preparing, dyeing, and finishing skins, for fine gloves, virified by actual experiment, and the communication accompanied with at least a dozen pair of gloves made from skins so prepared;—*the Gold Medal, or Forty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society on or before the last Tuesday in February, 1826.

Hose for Fire-Engines, Brew-houses, &c.

232. To the person who shall invent and make known to the Society a method of making hose for fire-engines, brew-houses, &c. similar to those used on the continent, made of flax or hemp, or other flexible material cheaper than leather;—*the Gold Isis Medal, or Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of its efficacy in practice, to be produced to the Society on or before the last Tuesday in February, 1826.

Thread for Lace.

233. To the person who shall invent and discover to the Society a method of manufacturing thread from flax, of as fine quality as any used on the continent;—*the Gold Medal, or Thirty Guineas.*

Samples of the thread, not less than one pound in weight, and of the lace made therefrom, together with certificates that not less than ten pounds in weight have been manufactured, to be produced to the Society on or before the last Tuesday in February, 1826.

Shawls of Cachemire Wool.

234. To the person who shall manufacture and produce to the Society a shawl made of Cachemire wool, and which shall be the best imitation of the real Indian shawls, made from the same material;—*the Gold Medal, or Thirty Guineas.*

Certificates from competent persons,

approving the articles manufactured, with a full account of the process employed therein, to be produced to the Society on or before the last Tuesday in February, 1826.

Shawls in imitation of Cachemire.

235. To the person who shall manufacture, of any material, except Cachemire wool, and produce to the Society a shawl equal in beauty, and in fineness of texture, to the best Indian shawls made of Cachemire wool;—*the Gold Medal, or Thirty Guineas.*

Conditions the same as for the preceeding.

Winding Silk.

236. To the person who shall invent and produce to the Society a method, better than any hitherto known, of winding raw silk that is in any degree sticky in its gum, or brittle in its texture, without injuring its colour or texture, or altering its weight, and at a cost not exceeding that of the ordinary methods;—*the Silver Medal, or Twenty Guineas.*

A full description of the process, and apparatus used, and samples of the silk, both in its wound and raw state, together with certificates of the process having answered the required conditions, to be produced to the Society on or before the last Tuesday in February, 1826.

Organzine Silk.

237. To the person who shall invent and produce to the Society a method by which to organzine silk equal in quality to the Italian throw, at an expense not more than two-thirds of the current price of throwing;—*the Gold Medal, or One Hundred Guineas.*

The communication, with a full description of the process, and models or drawings of the apparatus employed, and samples of the produce, with certificates of the invention answering the required conditions, to be produced to the Society on or before the second Tuesday in February, 1826.

Machine for Silk-weaving.

238. To the person who shall invent, and produce to the Society, a machine for weaving figured silks, superior in its mode of action, and in the nature and extent of the work it will produce, to the looms at present known;—*the Gold Medal, or Fifty Guineas.*

Certificates of the performance of the machine, and a model of the same, to be produced to the Society on or before the last Tuesday in March, 1826.

Machine for Weaving Ribbons.

239. To the person who shall invent, and produce to the Society a machine for weaving figured ribbons, superior in the nature and extent of the work performed to the looms at present known;—*the Gold Vulcan Medal, or Thirty Guineas.*

The improved plan to be capable of producing ribbons equal in texture to those of French manufacture, and to perform well in every respect. The entire height of the loom and its appendages not to exceed eight feet. The communication, together with specimens of the ribbons made with the improved loom, to be produced to the Society on or before the first Tuesday in February, 1826.

Power Looms for Figured Silk or Ribbons.

240. To the person who shall invent and produce to the Society a machine for weaving figured silks or ribbons, by which the best sorts of works may be executed, and to which steam, or any similar power may be applied;—*the Gold Medal, or Fifty Guineas.*

Conditions the same as the last.

Hat or Bonnet from Indigenous British Grass.

241. To the person who shall manufacture, or cause to be manufactured, and shall produce to the Society, on or before the first

Tuesday in February, 1826, the best hat or bonnet, made from spring-wheat or other article of British growth, which shall approach the nearest to the texture and colour of Leghorn-plat;—*the Silver Ceres Medal, or Ten Guineas.*

N. B. All hats and bonnets in claim of the premium offered must be sent precisely in the state in which they come out of the knitters' hands; that is, neither pressed nor bleached, it being the intention of the Society to have the whole of them pressed and bleached according to one and the same manner.

Plat from British Material.

242. To the person who shall manufacture, or cause to be manufactured, from spring-wheat or other material of British growth, and shall produce to the Society, on or before the first Tuesday in February, 1826, the largest quantity (not less than one hundred score) of plat fit for manufacturing bonnets, equal in texture to that imported from Leghorn;—*the Silver Medal, or Ten Guineas.*

243. For the next in quantity (not less than fifty score);—*the Silver Ceres Medal, or Ten Guineas.*

Matting.

244. To the person who shall manufacture and produce to the Society, the best specimen of matting, resembling India matting used for covering rooms, and made from materials grown in Great Britain;—*the Silver Medal, or Twenty Guineas.*

Certificates that not less than fifty yards of this matting have been manufactured, and that it will answer the purpose of India matting, and can be afforded at a less price, together with a sample of not less than six yards, and a complete account of the process of manufacture, to be produced to the Society on or before the first Tuesday in February, 1826.

British Cambric.

245. To the person who shall manufacture, or cause to be manufactured, in any part of the United Kingdom, the best specimen of cambric, not fewer than ten pieces;—*the Gold Vulcan Medal.*

Certificates, and one piece as a specimen, to be sent to the Society on or before the second Tuesday in March, 1826.

PREMIUMS IN MECHANICS.

Gunpowder Mills.

246. To the person who shall invent and discover to the Society the most effectual mode of preventing explosions in gunpowder mills;—*the Gold Medal, or One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more gunpowder mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1826.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of gunpowder-making, which fall short of the total prevention of explosion, such bounty or reward will be bestowed on them as they may appear to merit.

Machine for raising Coals, Ore, &c. &c. &c.

247. To the person who shall

invent and produce to the Society a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use, and which shall produce the effect at less expense;—*the Gold Medal, or Fifty Guineas.*

A model, with a certificate that a machine at large, on the same construction, has been advantageously used, to be produced to the Society on or before the second Tuesday in February, 1826.

Machine for raising Water.

248. To the person who shall invent a machine, on a better, cheaper, and more simple construction than any hitherto known for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal, or Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, to be produced to the Society on or before the last Tuesday in February, 1826.

Extinguishing Fires.

249. To the person who shall produce to the Society a method for preventing or extinguishing fire in buildings, superior to any now in use;—*the Gold Medal, or Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in January, 1826.

This premium is offered in compliance with a recommendation in the will of the late Dr. Anthony Fothergill.

Boring and Blasting Rocks.

250. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of boring and blasting rocks in mines, shafts, wells, &c.;—*the Gold Medal, or Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to th Society on or before the first Tuesday in February, 1826.

Heating Rooms.

251. To the person who shall invent and discover to the Society a method of heating rooms, superior to and cheaper than any hitherto known or in use;—*the Gold Medal, or Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society on or before the first Tuesday in February, 1826.

Improved Ventilation.

252. To the person who shall invent and produce to the Society a mode of permanently ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used;—*the Gold Medal, or Fifty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates, to be delivered to the Society on or before the first Tuesday in February, 1826.

Ventilating Coal Mines.

253. To the person who shall invent and carry into practice a method of ventilating coal mines so as effectually to prevent the accidents liable to arise from the accumulation of carburetted hydrogen and other gases;—*the Gold Medal, or Fifty Guineas.*

A full account of the process, with certificates of its efficacy, to be produced to the Society on or before the last Tuesday in February, 1826.

N.B. The Society will be very glad to attend to any communication, which, though not completely effecting the object, appears to offer an approximation to it. The Society wish particularly to refer candidates for this premium to the communication made by Mr. Ryan, and published in the 34th vol. of the "Transactions;" and will consider themselves obliged to any person who will furnish

any information with respect to the attempts which have been made to introduce Mr. Ryan's mode of ventilating coal mines into actual use, and of the success with which this method has been attended.

Preventing Accidents from Stage Coaches.

254. To the person who shall invent and discover to the Society a method of preventing accidents arising from stage coaches;—*the Gold Medal, or Thirty Guineas.*

Ample certificates of its efficacy, and a description of the method, with models of the machinery used, to be produced to the Society on or before the last Tuesday in February, 1826.

N. B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not, in some degree, be prevented by an alteration in the manner of placing the luggage.

Preventing Accidents from Horses Falling with Two-wheeled Carriages.

255. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, of preventing accidents from the falling of horses with two-wheeled carriages, especially on steep declivities;—*the Gold Medal, or Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates that the same has been used with success, to be delivered to the Society on or before the second Tuesday in February, 1826.

Improving Turnpike and other Roads.

256. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiment, of combining the materials ordinarily employed in making or repairing roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat, or any other mode, so as to form an even, hard, and durable carriage-road;—*the Gold Medal, or Thirty Guineas.*

It is required, that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society on or before the last Tuesday in February, 1826.

Preventing Prejudicial Effects to the Persons employed in Dry-grinding.

257. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of pointing needles, and other branches of dry grinding, during which the particles of grindstone-dust, steel, and iron, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal, or Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society on or before the first Tuesday in Feb. 1825.

Preventing Explosion in Steam-engine and other closed Boilers.

258. To the person who shall invent and discover to the Society a method of rendering closed boilers used for steam-engines and other purposes safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal, and not less than Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society on or before the last Tuesday in Feb. 1825.

Machine for Sweeping Chimnies.

259. To the person who shall invent and produce to the Society an apparatus for sweeping chimnies superior in facility of application and efficacy to any hitherto used;—*the Gold Medal, or Fifty Guineas.*

A complete model and description of the apparatus, with certificates of its successful and continued use, to be produced to the Society on or before the first Tuesday in March, 1826.

A superior Screw.

260. To the person who shall invent and make known to the Society any mode of producing a screw more perfect than any hitherto known;—*the Gold Medal, or Thirty Guineas.*

A model or complete drawing and description of the method, with a screw not less than twelve inches in length, to be produced to the Society on or before the first Tuesday in February, 1826.

Working Drawings of a Steam-Engine.

261. To the person who shall produce to the Society the best working drawings, in plan, elevation, and section, of a condensing steam-engine, in its most improved state, with a full detail of its several parts, and an accurate description thereof;—*the Gold Vulcan Medal, or Thirty Guineas.*

The drawings and description to be produced to the Society on or before the first Tuesday in March, 1826; and, if rewarded, to remain the property of the Society.

Canal Locks.

262. To the person who shall invent and communicate to the Society a plan of a lock for a canal, by which, on the passing of a boat, less water may be expended than has hitherto been the case, and through which a boat may pass in a time not materially longer than is required for passing locks of the usual construction;—*the Gold Medal, or Fifty Guineas.*

Certificates of the plan having been successfully carried into practice, together with a full description, and drawings or models in illustration of the same, to be sent to the Society on or before the first Tuesday in March, 1826.

Passing Boats through Tunnels.

263. To the person who shall invent and communicate to the Society a method whereby a boat may be impelled or drawn through a tunnel not having a towing path, superior to those usually in practice, at an easy expense, and without injury to the tunnel;—*the Gold Medal, or Thirty Guineas.*

Conditions the same as the last.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE AND THE BRITISH COLONIES.

Curing Mackarel.

264. To the person who shall, in the year 1825, cure the greatest quantity of mackarel, not less in number than ten thousand, in the best manner, and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal, or Twenty-five Guineas.*

265. For the next greatest quan-

tity, not less than five thousand;—*the Silver Medal, or Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society on or before the first Tuesday in January, 1826, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums are extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

Cachemire Wool.

266. To the person who shall import the greatest quantity of real Cachemire wool, not less than one cwt., freed from the hair, and in a state fit for spinning;—*the Gold Medal.*

Samples of the wool, not less than five pounds weight, with bills of lading and other necessary documents to be produced to the Society on or before the last Tuesday in February, 1826.

This premium is continued two years longer on similar conditions.

Importing the Cachemire shawl-Goat.

267. To the person who shall have imported into the United Kingdom, subsequent to the 1st of January, 1825, the greatest number, not fewer than three females and two males, of the real Cachemire shawl-goat;—*the Gold Medal.*

Certificates that the goats are of the real Cachemire breed, and that they are in health at the time of making the communication, to be produced to the Society on or before the first Tuesday in February, 1826.

This premium is offered also for the years 1826 and 1827.

Nutmegs and Mace.

268. To the person who shall grow the finest sample of nutmegs or mace, of good and merchantable quality, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, or in any British plantation on the coast of Africa, or of the several islands adjacent thereto, or in the island of Sincapore, and equal to those imported from the islands of the East Indies;—*the Gold Medal.*

Satisfactory certificates from the governor, commander-in-chief, resident magistrate, or other competent local authorities, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday in January, 1826.

The same premium is offered for the years 1827, 8, 9, 30.

Cinnamon.

269. A premium similar to the preceding, and on the same conditions, is offered for the growth of cinnamon.

Cloves.

270. A premium, similar to the preceding, and on the same conditions, is offered for the growth of cloves.

For an account of cloves raised in the colony of Trinidad, see M. le Cadre's communication in vol. 43 of the Society's Transactions.

Pepper.

271. To the person who shall, in the year 1830, raise, in any of the British West Indian islands or colonies, and shall import the largest quantity, not less than 4 cwt., of good and marketable pepper;—*the Gold Medal, or Fifty Guineas.*

272. For the next greatest quantity, not less than two cwt.;—*the Gold Ceres Medal, or Thirty Guineas.*

Conditions the same as for No. 268.

Vanilla.

273. To the person who shall

import from any of the British West Indian islands the greatest quantity of vanilla beans, the produce of such island or colony, equal in quality to those produced in Poyais and on the coast of Mexico;—*the Gold Ceres Medal.*

Coditions the same as for No. 268.

Annatto.

274. To the person who, in the year 1825, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of annatto, equal to that imported from Spanish America, not less than one cwt.;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the governor or secretary of the respective settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1826.

True Cochineal.

275. To the person who, in the year 1825, shall import into the port of London, from any part of the British settlements in the East or West Indies, or any other British plantation, the greatest quantity of true cochineal, equal to that imported from Spanish America, not less than one hundred weight; —*the Gold Medal.*

A quantity of cochineal, not less than three pounds weight, with proper certificates, signed by the governor or secretary of the respective settlement, or other competent local authority, that the cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1826.

West India Indigo.

276. To the person who, in the year 1825, shall raise the greatest quantity of indigo of good quality, not being less than one thousand pounds weight, in the island of Jamaica, or any other British plantation in the West Indies, and shall import the same;—*the Gold Medal, or Fifty Guineas.*

Certificates from the governor or secretary of the colony, or from the justices of the peace, or other competent local magistrates, that the indigo was raised in the colony, together with samples, to be produced to the Society on or before the first Tuesday in December, 1826.

Extract of Mimosa Bark.

277. To the person who, in the year 1825, shall import into Great Britain the greatest quantity (not less than ten tons), of extract of mimosa bark, prepared in the colony of New South Wales, at a price not greater than that of the extract of foreign oak-bark, and equally applicable as that to the purpose of tanning;—*the Gold Isis Medal.*

Satisfactory certificates from the governor or secretary of the colony, or any competent local magistrate, that the extract was prepared from the bark of trees growing in the colony, together with a full account of the process of preparing it, and samples of the extract, to be produced to the Society on or before the last Tuesday in January, 1826.

Caoutchouc.

278. To the person who shall import from any British colony or settlement in the West Indies or on the coast of Africa, the greatest quantity, not less than one cwt. of good and marketable caoutchouc; —*the Gold Medal.*

Certificates from the governor or secretary of the colony, or any competent local magistrate, with samples, and an account of the mode of preparing the article, to be produced to the Society on or before the first Tuesday in December, 1828.

Silk.

279. To the person who, in the years 1825, or 6, shall raise in any British colony, and shall import, the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, from silk-

worms bred there;—*the Gold Medal, or Fifty Guineas.*

Specimens of the silk, not less than one pound, with an account of the method in which the silk-worms were managed, the kind of mulberry-trees from whence they were furnished with food, and particulars respecting the culture of the mulberry-trees for that purpose, to be produced to the Society on or before the first Tuesday in February, 1826 or 7.

280. For the next greatest quantity, not less than fifty pounds, on similar conditions;—*the Silver Medal, or Twenty Guineas.*

Satisfactory certificates from the governor, commander-in-chief, secretary of the colony, resident magistrates, or other competent local authority where the said silk was produced, and of the several particulars above-mentioned, to be delivered to the Society along with the samples required.

The same premiums are specially offered for the colonies of

281—282. The Cape of Good Hope;

283—284. The Mauritius;

285—286. New South Wales.

Short-reeled Brutia Silk.

287. To the person who, previous to the first of March, 1826, shall have imported into Great Britain the greatest quantity of Brutia or Levant silk, not less than five bales (heretofore long-reeled), of a reel not more than 75 inches in circumference, so as to be wound by the engines in ordinary use;—*the Gold Isis Medal, or Thirty Guineas.*

Proper certificates, with bills of lading, and samples of the silk, to be produced to the Society on or before the first Tuesday in March, 1826.

Olive Oil.

288. To the person who shall, in the years 1826, 1827, or 1828, manufacture and import the finest specimen of oil, not less than ten gallons, the produce of olives grown in any British colony in Africa or New South Wales;—*the Gold Medal.*

289. For the next greatest quantity, not less than six gallons;—*the Silver Medal.*

Specimens of the oil, not less than two quarts, together with satisfactory certificates, to be produced to the Society on or before the last Tuesday in February, 1827, 8, or 9.

Wine from the Cape of Good Hope.

290. To the person who shall import, in the years 1825 or 1826, the finest wine, not less than twenty gallons, of good marketable quality, made from the produce of vineyards at the Cape of Good Hope, or the parts adjacent;—*the Gold Medal.*

The above premium is not offered for the sweet or Constantia wine, the quality and value of which are sufficiently known, but to encourage the improvement of the vineyards more recently established.

Samples of the wine, in bottles, bills of lading, and certificates of the governor, secretary of the colony, or other local authorities, that the wine was made in the colony, to be produced to the Society on or before the first of March, 1826 or 7.

Wine from New South Wales.

291. To the person who shall import, in the years 1826 or 1827, the finest wine, not less than twenty gallons, of good marketable quality, made from the produce of vineyards in New South Wales;—*the Gold Medal.*

Samples of the wine, in bottles, bills of lading, and certificates of the governor, secretary of the colony, or other local authorities, that the wine was made in the colony, to be produced to the Society on or before the first of March, 1826, 7, or 8.

Dried Fruits.

292. To the person who shall prepare and import into Great Britain the greatest quantity, not less than 100lbs. of dried fruits, similar to those now imported from the Mediterranean, of good quality,

and the growth of the colony of New South Wales;—*the Gold Ceres Medal.*

Satisfactory certificates from the governor or secretary of the colony, or any competent local magistrate, that the fruits were grown and prepared in the colony, with samples of the fruits, to be presented to the Society on or before the first Tuesday in February, 1826.

This premium is also extended to 1827 and 1828.

The same premium, on similar conditions, is offered for the colonies of—

293. The Cape of Good Hope.

294. The Mauritius.

Cultivation of Tea.

295. To the person who shall grow and prepare the greatest quantity of China tea, of good quality, not being less than 20 lbs. weight, in the island of Jamaica, or in any other British West India colony, and shall import the same into Great Britain;—*the Gold Medal, or Fifty Guineas.*

Satisfactory certificates from the governor or secretary of the colony, or from the justices of the peace, or other competent local magistrate, that such tea was grown and prepared in the colony; together with an account of the number of tea-trees, their age, mode of culture, of gathering, drying, and preparing the leaves, and samples of the tea, to be produced to the society on or before the first Tuesday in February, 1827. This premium is also extended to 1828.

The same premium is offered for the colonies of

296. The Cape of Good Hope;

297. The Mauritius;

298. New South Wales, and the British dominions in the East Indies.

China Tea.

299. To the person who shall communicate to the Society, from information obtained in China, the best and most authentic account of the culture of the plant or plants, the leaves of which furnish the different kinds of tea; together with the method of gathering, drying, and otherwise preparing the leaves;—*the Gold Medal.*

The communication, with the necessary certificates, to be sent in to the Society on or before the first Tuesday in March, 1826.

This premium is extended to the years 1827 and 1828.

Kali for Barilla.

300. To the person who shall have cultivated, in the Bahama Islands, or any other part of his majesty's dominions in the West Indies, or in any other British plantation, in the year 1825, the greatest quantity of land, not less than two acres, with a kali equal to the Spanish kali for the purpose of making barilla;—*the Gold Medal, or Thirty Guineas.*

301. For the next greatest quantity, not less than one acre;—*the Silver Medal, or Fifteen Guineas.*

Certificates, signed by the governor or commander-in-chief for the time being, the resident magistrates, or other competent local authorities, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in February, 1826.

The same premiums, on similar conditions, will be given for kali grown in 1826.

Cultivation of Hemp in Upper and Lower Canada, Nova Scotia, and New Brunswick.

302. To the person who shall sow with hemp the greatest quantity of land in the above-mentioned provinces, not less than six arpents, (each four-fifths of a statute acre) in the year 1825, and shall at the proper season cause to be plucked the summer hemp, (or male hemp

bearing no seed,) and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal, or Two Hundred Dollars.*

303. To the person who shall sow with hemp the next greatest quantity of land in the same provinces, not less than five arpents, in the year 1825, in the manner above-mentioned;—*the Silver Medal, or One Hundred Dollars.*

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad-cast or in drills, and of the expense, soil, cultivation, and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, of the resident magistrates or other competent local authorities, together with 28lbs of the hemp, and two quarts of the seed, on or before the last Tuesday in April, 1826.

The same premiums are offered for the year 1826.

Importation of Hemp from Canada, Nova Scotia, and New Brunswick.

304. To the person who shall import to this country the greatest quantity of marketable hemp, not less than one hundred tons, in the year 1825, the produce of Canada, or of one of the above-mentioned provinces;—*the Gold Medal.*

305. To the person who shall import the next greatest quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel on or before the last Tuesday in April, 1826, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

The same premiums are offered for the year 1826.

Substitute for Hemp.

306. To the person who, in the years 1825, or 1826, shall raise at the Cape of Good Hope, in New South Wales, or in any of the British colonies, and import, a substitute for hemp, not less than two tons, equally cheap, strong, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal, or Fifty Guineas.*

A quantity of the substitute, not less than 20 lbs., together with the proper certificates from the governor, commander-in-chief, secretary of the colony, resident magistrates, or other competent local authority, in which the same has been raised, to be produced to the Society on or before the last Tuesday in February, 1826.

The Society particularly direct the attention of the public to the phormium tenax or New Zealand flax.

The same premiums are offered for the year 1826.

China Paper for Copper-plate Printing.

307. To the person who shall communicate to the Society the best account of the process employed in China for the manufacture of paper used in England for copper-plate printing, and known by the name of India paper, together with an account of the materials from which such paper is made;—*the Gold Medal, or Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates, to be produced to the Society on or before the first Tuesday in February, 1826, or 1827.

Diminution of Human Labour in the Cultivation of Sugar, &c.

308. To the person who, previous to the first of January, 1826, shall present to the Society a satisfactory account, founded on experience, of the most advantageous mode of diminishing the labour of persons employed in the cultivation of sugar, cotton, and coffee in the West Indian colonies, by the substitution of agricultural machinery, or by the use of cattle;—*the Gold Medal, or Fifty Guineas.*

Extirpating the Stumps and Roots of Trees.

309. To the person who shall invent and discover to the Society the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees which have been left after felling the timber, so as to clear the land for the purposes of cultivation;—*the Gold Medal, or Fifty Guineas.*

Certificates that the method has succeeded with at least fifty trees of large girth, and a full description of the means employed, to be delivered to the Society on or before the last Tuesday in February, 1826.

BRITISH MARBLES.

THE Society, considering that it would be beneficial to the commerce of the United Kingdom to bring the British marbles into general use, and that the most effectual method of accomplishing their object would be, *for the present,* to make them more generally known in the capital, have come to the following resolution:—

That specimens of British marbles be exposed in the Society's rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name and situation of the parish, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future enquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of marble quarries will favour them with a specimen of the marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected, that the interest of the proprietors of the quarries will be promoted, and the use of British marble much extended. A variety are already exhibited in the Society's rooms.

REWARDS

BESTOWED BY THE SOCIETY DURING THE SESSION 1824-5.

IN AGRICULTURE AND RURAL ECONOMY.

1. To Ralph Creyke, jun. Esq. Rawcliffe House, near Thorne, Yorkshire, for warping 429 acres of peat, by an improved method, the *large Gold Medal.*
2. To Col. James Wilson, Sneaton Castle, near Whitby, for planting 174 acres with forest trees, *the large Gold Medal.*
3. To Messrs. Cowley and Staines, Winslow, Bucks, for raising seed from the American grass used in making fine plat, *Twenty Guineas.*
4. To Mr. Wm. Salisbury, Barossa Place, Brompton, for his communication respecting the material employed in Tuscany for fine plat, *the Silver Ceres Medal.*
5. To Gorge Whitworth, Esq. Acre house, near Caistor, Lincolnshire, for his improved perennial rye grass, the *Silver Ceres Medal.*

IN CHEMISTRY.

6. To Mr. J. Roberts, St. Helen's, Lancashire, for his apparatus to enable persons to breathe in air loaded with smoke and other suffocating vapours, the *large Silver Medal and Fifty Guineas.*
7. To Mr. H. Moore, Green Hill, Derby, for his mode of etching and cleaning alabaster, the *large Silver Medal.*
8. To Mr. L. Anstey, 27, Drummond Crescent, Somers'-town, for his improved melting pots for iron and brass-founders, the *Silver Vulcan Medal and Twenty Guineas.*
9. To Mr. W. Sturgeon, 9, Artillery Place, Woolwich, for his improved Electromagnetic apparatus, the *large Silver Medal, and Thirty Guineas.*

IN MECHANICS.

10. To Mr. W. Friend, Earl-street, Clifton-street, Finsbury, for a secret lock, *Ten Guineas.*
11. To Mr. J. P. Hubbard, 130, Leadenhall-street, for a folding chair, the *Silver Vulcan Medal.*
12. To Mr. C. W. Williamson, New-street, Elizabeth-place, Kennington Cross, for an improved smoothing plane, *Ten Guineas.*
14. To Mr. T. Griffiths, Royal Institution, for an expanding wedge for sawyers, the *Silver Vulcan Medal.*
13. To Mr. David Matthews, Basinghall-street, for his improved mode of barrowing out soil, the *Silver Vulcan Medal.*
15. To Mr. Elisha Pechey, Bury St. Edmunds, for his pump for raising water, *Five Guineas.*
16. To Mr. T. Cluley, Sheffield, for his lithotomy forceps, the *Gold Vulcan Medal.*
17. To W. Brockedon, Esq. Caroline-street, Bedford-square, for a mechanical apparatus to assist a weak knee-joint, the *large Silver Medal.*
18. To Mr. J. Aitkin, 55, St. John-street, Smithfield, for his improved quarter clock, *Twenty Guineas.*
19. To Mr. W. Hardy, Wood-street, Spa Fields, for an instrument to ascertain very small intervals of time, the *Gold Vulcan Medal.*
20. To T. Dickinson, Esq. Capt. R. N. Purbrook Heath, near Portsmouth, for his mode of applying percussion powder to the discharge of ships' guns, the *Gold Vulcan Medal.*
21. To. Mr. J. Cow, Master Boat-builder, Royal Dock Yard, Woolwich, for his improved mode of conveying anchors and cannons by means of a ship's launch, the *Gold Vulcan Medal.*

22. To Alfred Ainger, Esq. Everett-street, Brunswick-square, for his centering for arches of wide span, the *Gold Vulcan Medal.*
23. To Mr. C. Sockl, 17, Royal-row, Lambeth, for a safe valve for steam-boilers, the *large Silver Medal and Ten Guineas.*
24. To Colin Shakespear, Esq. Postmaster General, Calcutta, for a portable rope bridge, the *Gold Vulcan Medal.*

IN MANUFACTURES.

25. To Mr. R. Jones, Master of St. George's Workhouse, Little Chelsea, for cloth made of New Zealand Flax, the *Silver Ceres Medal and Five Guineas.*

Rewards given for Bonnets of British materials in imitation of Leghorn.

26. Mr. James Cobbin, Bury St. Edmunds, *Fourteen Guineas.*
27. Mrs. Syrett, ditto, *Ten Pounds.*
28. Mrs. Venn, Hadleigh, Suffolk, *Nine Guineas.*
29. Anne Venn, ditto, *Three Guineas.*
30. Mr. James Long, Barham House of Industry, the *Silver Ceres Medal.*
31. The Children of the School at Adbury, Berks, *Five Guineas.*
32. Lucy Hollowell, Banbury, *Five Guineas.*
33. Mary Marshall, Bandon, near Cork, *Two Guineas.*
34. The Children of the School at Bandon, *Three Guineas.*
35. Sophia Dyer, West Meon, near Alton, *Two Guineas.*
36. Anne Dyer, ditto, *Two Guineas.*
37. Maria Pain, Boxted, near Bury St. Edmunds, *Two Guineas.*
38. Mrs. Morrice, Great Brickhill, Bucks, the *Silver Ceres Medal.*
39. Mrs. Lowrey, Exeter, the *Silver Ceres Medal.*

IN COLONIES AND TRADE.

40. To J. Mackay, Esq. Picton, Nova Scotia, for an instrument for uprooting trees, the *Gold Ceres Medal.*
41. To Messrs. Petchey and Wood, Van Diemen's Land, New South Wales, for making and importing five tons of extract of Mimosa bark for the use of tanners, the *Gold Ceres Medal.*
42. To M. Le Cadre, Trnidad, for his plantations of clove trees in the colony of Trinidad, *Fifty Guineas.*

IN POLITE ARTS.

COPIES IN CHALK, PENCIL, AND INDIAN INK.

43. To Miss Cockburn, St. John's Wood, Regent's Park, for a pencil drawing of an historical subject, the *large Silver Medal.*
44. To Mr. J. B. Sedgwick, 20, Fleet-street, for a pencil drawing of a landscape, the *Silver Isis Medal.*
45. To Mr. T. Wilkinson, 2, James-street, Adelphi, for a pencil drawing of a landscape, the *Silver Palette.*
46. To Miss Anne Hoare, 9, Great Cumberland-street, for a chalk drawing of a head, the *Silver Isis Medal.*
47. To Miss Sarah Field, Grove Lodge, Lower Tooting, for a chalk drawing of a figure, the *Silver Palette.*
48. To Miss Sale, 10, Westminster Bridge Road, for a chalk drawing of a head, the *Silver Palette.*
49. To Miss Henrietta Tufnell, Bath, for a pencil drawing of a landscape, the *Silver Palette.*
50. To Miss Amenaide Millot, 17, Sloane-street, for a chalk drawing of an historical subject, the *large Silver Medal.*
51. To Miss Martha Smith, 17, Norfolk-street, Strand, for a chalk drawing of a head the *Silver Palette.*
52. To Miss Louisa Honor Fox, London House, Hackney, for a crayon drawing of figures, the *large Silver Medal.*
53. To Mr. J. Bizot, Down-street, Piccadilly, for a chalk drawing of a head, the *Silver Palette.*
54. To Mr. F. R. Ridgard, Euston-square, for a chalk drawing of a figure, the *Silver Palette.*

DRAWINGS FROM BUSTS.

55. To Miss Diana Lawrance, 357, Oxford-street, for a finished drawing in chalk from a bust, the *large Silver Medal.*

56. To Miss Harriet Salmon, 86, Piccadilly, for a finished drawing in chalk from a bust, the *Silver Isis Medal.*

COPIES IN WATER COLOURS.

57. To Miss Juliana Selina Guy, 3, Bartlett's-place, Holborn, for a landscape, *the large Silver Medal.*

58. To Miss Waters, Clapton-square, for a portrait in miniature, *the Silver Isis Medal.*

59. To Miss Harriet Howell Morton, 4, Jeffery-street, Camden-town, for a group of flowers, *the large Silver Medal.*

60. To Miss Clark, 22, Charter-House-square, for a group of flowers, *the Silver Isis Medal.*

61. To Miss Ellen Hargrave, Greenwich, for a group of flowers, *the Silver Palette.*

ORIGINAL IN WATER COLOURS.

62. To Mrs. Carbonnier, 64, George-street, Portman-square, for a portrait in miniature, *the large Silver Medal.*

63. To Miss A. A. Bond, 20, York-place, Kentish-town, for a group of flowers, *the large Silver Medal.*

64. To Mr. W. Downer, 4, Brewer-street, Woolwich, for a group of flowers, *the Silver Isis Medal.*

COPY IN OIL.

65. To Miss Emily Evans, Craven-street, Kentish-town, for a landscape, *the Silver Isis Medal.*

ORIGINAL IN OIL.

66. To Mr. J. P. Andre, jun. 5, York-place, City-road, for a group of flowers, *the Silver Isis Medal.*

67. To Miss Manning, the Priory, near Leatherhead, for a portrait of a lady, *the large Silver Medal.*

68. To Miss E. Ainsley, Kentish-town, for a composition in still-life, *the Gold Isis Medal.*

69. To Mr. G. Hilditch, 13, Ludgate-street, for a composition of fish from nature, *the large Silver Medal.*

COPIES IN CHALK, PENCIL, OR INDIAN INK.

70. To Mr. D. Pasmore, 6, Salisbury-square, Fleet-street, for an historical drawing in pencil, *the Silver Isis Medal.*

71. To Mr. T. Percy, 42, Cleveland-street, Fitzroy-square, for a drawing in Indian Ink, of a landscape, *the Silver Palette.*

72. To Mr. Edgar G. Papworth, 10, Caroline-street, Bedford-square, for a drawing in pencil of animals, *the Silver Isis Medal.*

73. To Miss Alderson, 4, Bridge-row, Pimlico, for a drawing in chalk of a head, *the Silver Palette.*

74. To Miss Mary Eliza Friend, Clark's-terrace, Cannon-street-road, for a drawing in pencil of animals, *the Silver Palette.*

75. To Miss Liddle, 19, White lion-street, Goodman's Fields, for a drawing in chalk of a head, *the Silver Isis Medal.*

ORIGINAL IN CHALK, PENCIL, OR INDIAN INK.

76. To Mr. S. Lines, jun. Birmingham, for a drawing in pencil of a landscape, *the large Silver Medal.*

77. To Mr. Ed. Watt Webb, Tamworth, for a pencil drawing of animals, *the Silver Isis Medal.*

78. To Miss C. E. Walker, Blyth Hall, Bawtry, for a pencil drawing of a landscape, *the large Silver Medal.*

DRAWINGS AND PAINTINGS FROM STATUES AND BUSTS.

79. To Mr. H. T. Wright, 52, Great Titchfield-street, for an outline of an entire figure, *the large Silver Medal.*

80. To Mr. R. W. Warren, Brewer-street, Woolwich, for a finished drawing of an entire figure, *the large Silver Medal.*

81. To Mr. L. B. Adams, 5, Basinghall-street, for a finished drawing of an entire figure, *the Silver Palette.*

82. To Mr. B. R. Green, 27, Argyll-street, for an outline of an anatomical figure, *the large Silver Medal.*
83. To Mr. W. Christie, Queen's Buildings, Brompton, for a drawing in chalk from a bust, *the Silver Isis Medal.*
84. To Mr. S. Caterson Smith, 11, Margaret-street, Bagnigge Wells, for a painting in oil from a bust, *the Silver Isis Medal.*

COPIES IN WATER COLOURS.

85. To Mr. J. Kennedy, for a drawing of an historical subject, *the large Silver Medal.*
86. To Mr. G. Brown, 6, Argyll street, for a drawing of an historical subject, *the Silver Isis Medal.*
87. To Mr. C. R. Bone, 47, Charlotte-street, Portland-place, for a portrait in miniature, *the large Silver Medal.*
88. To Miss Letitia Jane Green, 27, Argyll-street, for a portrait in miniature, *the Silver Isis Medal.*

ORIGINAL IN WATER COLOURS.

89. To Miss Emma Fearnley, 6, Mecklenburg-square, for a group of flowers, *the Silver Isis Medal.*
90. To Miss Emma Tomkins, 53, New Bond-street, for a composition of flowers, *the large Silver Medal.*

COPY IN OIL.

91. To Mr. W. A. Hastings, 8, Alfred-place, Bedford-square, for a painting of shipping, *the Silver Isis Medal.*

ORIGINAL IN OIL.

92. To Mr. Evan Williams, 6, Charlotte-street, Bloomsbury, for an historical composition, *the large Gold Medal.*
93. To Mr. A. R. Venables, 6, Charlotte-street, Bloomsbury, for a portrait of himself, *the Silver Isis Medal.*
94. To Mr. Richard E. Holst, 14, Howland-street, for a portrait of a lady, *the Silver Palette.*
95. To Mr. Ed. Fancourt, 31, Hoxton-square, for a portrait of himself, *the large Silver Medal.*
96. To Miss Kearsley, 12, Rathbone-place, for a portrait of a lady, *the Silver Palette.*
97. To Mr. J. St. John Long, 20, York-street, Portman-square, for a landscape composition, *the large Silver Medal.*
98. To Mr. Richard A. Clark, 3, Clarendon-square, for a landscape composition, *the Silver Isis Medal.*
99. To Mr. H. H. Lines, Birmingham, for a landscape from nature, *the Silver Isis Medal.*

MODELS.

100. To Mr. T. Hughes, 59, Long Acre, for a copy of a bust from the antique, *the large Silver Medal.*
101. To Mr. Constantine Panormo, 91, Dean-street, Soho, for a copy, in the round, of an entire figure, *the large Silver Medal.*
102. To Mr. E. G. Physick, 16, Park-terrace, Regent's Park, for an original model of a group, *the Gold Isis Medal.*
103. To Miss Sybella Bullock, 119, Sloane-square, for a bust from the life, *the large Silver Medal.*

ARCHITECTURE.

104. To Mr. Stephen Burchell, 24, Red Lion-square, for a drawing in perspective from a Corinthian Capital, *the Silver Isis Medal.*
105. To Mr. Samuel Loat, 24, Edward-square, Kensington, for an original design in Greek architecture, comprising seven dwelling houses, *the large Silver Medal.*
106. To Mr. D. Mocatta, 33, Russell-square, for an original design for a church in Doric architecture, *the Silver Isis Medal.*
107. To Mr. Henry Bassett, 15, Norfolk-street, Strand, for an original design for a church in Doric architecture, *the Gold Medallion.*

LITHOGRAPHY.

108. To Mr. J. Baker, Sydenham Common, for a drawing of a Gothic screen to a church, *the large Silver Medal.*
109. To G. Tytler, 10, Villiers-street, Strand, for a drawing of the interior of King's College Chapel, Cambridge, *the Silver Isis Medal.*

MEDAL DIE AND GEM ENGRAVING.

110. To Mr. W. Woodhouse, Pupil to Mr. Halliday, Birmingham, for two medal dies, copies, the one a head, the other an entire figure, *the Silver Isis Medal.*

111. To Mr. T. Warner, 182, Terrace, Tottenham Court-road, for a head in intaglio, a copy, *the large Silver Medal.*

112. To Mr. Raphael Clint, 5, Rolls Buildings, for an original intaglio of a head, *the Gold Isis Medal.*

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113. To Mr. J. Wood, 20, Surrey-street, Strand, for an original design for the Society's vignette, *the large Silver Medal.*

114. To Miss A. Miller, Dorset-street, Dublin, for carvings in ivory of heads and figures, *the Gold Isis Medal.*

115. To Mr. W. Savage, 11, Cowley-street, Westminster, for block printing in colours in imitation of drawings, *the large Silver Medal and Fifteen Guineas.*

116. To Mr. Hen. Attenburrow, Student in Surgery, 11, New Burlington-street, for an original coloured anatomical drawing, *the Silver Isis Medal.*

117. To Mr. J. R. Alcock, Student in Surgery, 11, New Burlington-street, for an original anatomical model in coloured wax, *the Gold Isis Medal.*

The Thanks of the Society have been voted to the following Gentlemen, and their Communications have been directed to be inserted in the next Volume of the Society's Transactions.

To Capt. T. M. Bagnold, High-row, Knightsbridge, for his successful application of M. Appert's process to the preservation of lime-juice.

To the same Gentleman and to his Brother, Capt. M. E. Bagnold, of Bombay, for an account of the process employed at Bombay for making twisted gun barrels and sword blades, in imitation of those made at Damascus.

To Mr. Jas. Clement, Prospect-place, Newington Butts, for his stand for drawing boards of large area.

To Mr. C. Varley, Thornhaugh-street, for his mode of copying screws.

To Mr. Turrell, Clarendon-square, for his improved etching ground for engravers.

The Thanks of the Society have also been voted

To M. Moreau, Soho-square, for his tabular view of British commerce.

To Mr. J. H. Abraham, Sheffield, for his magnet for extracting particles of iron and steel from the eyes of workers in that metal.

TRANSACTIONS

OF

THE SOCIETY

DURING THE SESSION 1824-25.

PAPERS

IN

AGRICULTURE.

No. I.

WARPING PEAT MOSS.

The LARGE GOLD MEDAL *was this session presented to* RALPH CREYKE, *Jun., Esq., of Rawcliffe House, near Thorne, Yorkshire, for warping 429 acres of Peat Moss.*

THE process of warping was first practised, it is said, about the middle of the last century, on some land in the neighbourhood of Howden, on the Humber. Not only the waters of the Humber itself, but the Trent, the Don, the Ouse, and other rivers which contribute to form that estuary, are, near their mouths (especially during spring tides) filled with very muddy water. This mud is not brought in from the sea, for the Humber is clear at its mouth; nor does it originate from land floods, for these are observed always to injure the *warp* or deposit; it

therefore arises from the action of the tide water on the beds of soft shaly clay which form the bottom of the Lincolnshire marshes, and in which, in all probability, the estuary of the Humber has been excavated. All the embanked lands on these rivers being on a lower level than spring tides, are capable of being warped, which consists in surrounding the land intended to be so treated with a substantial bank, and then letting in the tide water, and allowing it to remain on the land till it has deposited nearly the whole of its mud. Thus the old soil is benefitted by the addition of new, or an entirely fresh soil is laid on the surface of the old, according to the thickness of the deposit, or the length of time that the warping is persevered in.

The usual mode of warping is to dig a main canal, or trunk, having a sluice towards the river, and to divide the lands on each side of the drain, by means of banks, into compartments of from ten to twenty acres each, and to make an entrance sluice to each compartment, together with one or more return sluices called *cloughs*. During the spring tides, in the months of August, September, and October, the sluice of the main trunk being opened, the tide water enters it, and is distributed by the lateral entrance sluices to as many of the compartments as may be convenient. When the tide is at its height, each of these entrance sluices is closed; and, as it ebbs, the hydrostatic pressure of the water in the compartments forces outwards the swinging door of the clough, and thus allows the water to escape into the main trunk, and thence into the river, having deposited nearly the whole of its mud on the surface of the inclosure in which it was penned up. The size of the cloughs should be so adjusted as to dis-

charge the whole of the water before the rise of the next tide, otherwise only every other tide can be admitted. By this operation a deposit of silt, of the thickness of from twelve to sixteen inches, may be obtained in one season.

Mr. Creyke having ascertained that a tract of about 1600 acres of peat moss, in the neighbourhood of Rawcliffe, which produced absolutely no rent, was at a sufficiently low level to be warped; resolved to subject the whole to this mode of rendering it productive; the way in which this was effected is detailed in the following extracts from that gentleman's letters, addressed to the Secretary of the Society.

Rawcliffe House, near Thorne, Yorkshire,
Sir, Nov. 18, 1824.

In the neighbourhood of Rawcliffe House, where I reside, are many thousand acres of peat moss and waste land, which yield scarcely any annual rent, and which I thought (from the experience I had got in improving a considerable quantity of my own land near home) might be improved very much by being warped. I accordingly undertook to warp from the river Ouse 1600 acres; and in August, 1821, a sluice, with two openings of sixteen feet each, and nineteen feet high from the sole to the crown of the arch, with substantial folding doors, was built and opened; and at the same time a main drain was cut, extending from it two miles and a half, up to the waste land and peat moss: its dimensions were thirty feet wide at the bottom, and ninety feet wide at the surface of the land,

and the banks were raised upon the land to the height of ten feet. The ordinary spring tides flow to the height of sixteen feet, where the sluice is built. In the first year 429 acres of waste land were embanked, in order to be improved; and on it was deposited, in the course of that year, a fine alluvial soil, of the average depth of near three feet. This allotment was sown with oats and seeds in 1823, and the seeds were either mown or depastured in 1824; and it is now sown with wheat, which looks very promising and luxuriant. No part of this allotment of 429 acres yielded any rent previous to this improvement, and now no part of it is let for less than thirty-five shillings per acre. The expense is twenty-one pounds per acre. I am proceeding with two other allotments, containing a greater number of acres in each, of which, when finished, I will send you an account, if this be honoured with the approbation of the Society.

I am, Sir,

&c. &c. &c.

RALPH CREYKE, Jun.

A. Aikin, Esq.
Secretary, &c. &c.

Sir, Rawcliffe House, March 24, 1825.

I BEG leave to acknowledge the receipt of your letter, dated 1st March. I trust that I shall be able to satisfy the committee that my claim for the large gold medal is strictly conformable to the terms for which they offer it, namely, "for an account of a method superior to any hitherto practised of improving land lying waste."

The superiority consists in creating a fine deep rich soil, more effectually, upon a larger scale, and in a shorter

time, than has hitherto been practised. According to the usual practice, the tides were only admitted during the months of August, September, and October; in mine they are admitted the year round. The sluice was not more than five feet wide; mine has two openings of sixteen feet wide. The main drain was only twelve feet wide; mine is ninety feet wide. Not more than fourteen acres were embanked in one piece; I have inclosed five hundred acres in one compartment. Formerly not more than one and a half feet of deposit was obtained; I have got from three to four feet in the same time, upon the increased quantity of land. No levels used to be taken for the formation of the banks; the whole of my embankment has been laid out by the spirit level. Scarcely any inlets used to be made for the purpose of spreading the tide water quicker and more equally over the surface of the land within the embankment, as well as for the more speedy return of it upon the ebb; in my practice innumerable inlets are formed for this purpose. It is quite impossible to give a detailed account of the arrangement of these inlets; they must, in all cases, vary with the shape and different levels of the land embanked, and on that account no exact statement of cost can be given; it is, however, very considerable. The width of the inlets varies from fifty feet to three feet, the depth from seven feet to one foot.

There is much more difficulty in the interior management than any other part; the knowledge of it can only be acquired by practice and close observation. There is likewise a very considerable annual expense in the repairs of the main drain, more particularly of that part near the

sluice. A loss of one thousand pounds was experienced the first year, owing to a breach of the bank of the main drain. In my first letter I named 429 acres, at that time growing a fine luxuriant crop of wheat: I now beg to add 500 acres more, at this moment in a state of preparation for being sown with oats and grass seeds this spring; and that 600 acres more will be finished in the course of the present year.

I am, Sir,

A. Aikin, Esq.
Secretary, &c. &c.

&c. &c. &c.
RALPH CREYKE, Jun.

Queries sent by the Secretary to Mr. Creyke, 1st March, 1825; with that Gentleman's Answers.

1. Expense of erecting the sluice, divided into labour and cost of materials; the nature of such materials, whether brick or stone?

The sluice is built of stone of large size, backed with brick; the foundation was well piled with 550 piles, thirteen feet long, squaring eleven inches, upon which were firmly secured very strong beams; upon the beams the whole space upon which the sluice was built was planked with four-inch deals, another set of beams were placed crossways, and then a second floor of three-inch plank. Sleeting piles were driven the whole length of the wood work, both fronting the river and next the main drain; a wall is also erected from the sluice to the river, to protect the bank from being injured. The cost of the sluice,

£4,800; the cost of the wall, £300; £340 more for a residence, and stone for materials, for the person attending upon the tides, &c. &c.

2. Expense of the main drain?

The expense of the main drain, being three and a half miles long, was £7,350, exclusive of the purchase of the land, £4,682; the dimensions of it were ninety feet wide at the surface of the land, eleven and a half feet deep, and thirty feet wide at the bottom; at the width of nine feet from the edge of the main drain is placed the bank, the base of which is sixty feet, and the height ten feet; the bank is made as strong as possible by puddling. The main drain is used as a canal, and is found of great benefit to the lands adjoining.

3. Length, and other dimensions, and materials of the embankment to retain the water on the land to be warped, and cost of the same?

The length of the embankment to retain the tide-water must depend upon the quantity of land embanked; these banks must be well puddled, and made with the greatest care. The dimensions of our banks are thirty-two feet at the base, ten feet high, and six feet wide at the top. The cost of them, three shillings per floor of twenty poles.

4. Elevation of the peat moss above low water at neap tides?

The level of the peat moss varies very considerably; the lowest parts of it are not more than four feet above low water mark; the highest as much as thirteen feet above low water mark.

5. Did the peat undergo any operation of levelling, &c. previous to the water being let in upon it?

The peat moss will, in the first instance, settle very con-

siderably, by the drainage produced by the cutting of the various inlets; and afterwards by the pressure of the soil deposited: it undergoes no levelling.

6. Was the water let on every spring tide, or how many tides? How long did it remain on the land? How long was it in flowing off the land before the next spring tide was admitted?

Every tide is admitted during the spring tides, and occasionally during the neap tides; care should, however, be taken not to admit any tides when it blows strong, as the banks are subject to great injury at those times, and the warp does not deposit, from the agitated state of the water, the water returns from the land with the ebb. In the river Ouse, at the point where the sluice is erected, the tides flow to their height in three hours, and ebb nine hours. The height is from eighteen feet to fourteen feet.

7. Are there any seasons of the year, or other circumstances, that affect the amount of the silt deposited?

The water in the river will at times be so much affected by land floods, in very rainy weather, that it is not worth admission; in dry weather the amount of silt is nearly the same; in the hotter months the proportion of salt in the silt is greater than at other times.

CERTIFICATE.

Saltmarshe, near Howden, Yorkshire.

We, the undersigned, two of his majesty's justices of the peace for the county of York, and residing in the neighbourhood of the peat moss and waste grounds alluded

to in a letter from Ralph Creyke, Jun., Esq., to the Secretary to the Society for the Encouragement of Arts, &c. &c., dated 18th November, 1824, do certify, that we have seen the said peat moss frequently previous to the improvement by warping, at which time it was of little or no value, and produced no rent to the owners; that we have seen it since the warping was completed; that it is now in a state of cultivation, and capable of producing the most abundant crops of corn, grass, and every other kind of produce.

Given under our hands the 24th Nov. 1824.

PHILIP SALTMARSHE.
ROB. DENISON, Jun.

No. II.

PLANTING TIMBER.

The LARGE GOLD MEDAL, *being the premium offered, was this session given to Col.* JAMES WILSON, *of Sneaton Castle, near Whitby, for planting 174 acres of Moor Land with Forest Trees.*

COL. WILSON'S first communication was imperfect, in consequence of his not being acquainted with the conditions under which the premium is offered by the Society. The Secretary was therefore directed to write to him, stating the several heads on which the Society required information. To that letter, the following reply, with its inclosure, was received.

SIR, Sneaton Castle, 9th April, 1825.

On receipt of your letter of 29th March, I handed it over to my steward, Mr. Peter Scott, with a desire that he would give a correct account and statement of all you required respecting the young plantations established by me on the Sneaton estate; and I have now the satisfaction to enclose, for the information of the Society, his statement on that subject, which will no doubt be found correct and satisfactory. I am, Sir,

&c. &c. &c.

JAMES WILSON.

A. Aikin, Esq.
Secretary, &c. &c.

N. B. The surveyor's certificate as to the 174 acres is annexed to Mr. Scott's letter.

J. W.

Sir, Sneaton, 7th April, 1825.

I HAVE read Mr. Aikin's communication to you on the subject of your young plantations, and beg to say, that all contained in Mr. Redman's certificate comes under the dates mentioned in Mr. Aikin's letter, except the Maybeck plantation, 21 acres; this has only been supplied last autumn, and must have been planted long previous to 1st Oct. 1820; it therefore cannot come under the meaning of Mr. Aikin's letter. The quantity planted in the spring of 1820, say from January to March; and from December, 1820, till 31st March, 1821, amount exactly to one hundred and seventy-four acres, completely established, and all in a thriving state, and will, in a few years more, be a great ornament to this part of the country; in fact, it is so already. The whole of the above is in the parish and lordship of Sneaton, excepting the four acres which form part of the plantations round Sneaton castle, in the parish of Ruswarp, adjoining that of Sneaton. The soil of these four acres is *rich* and good, but all the rest, or nearly so, is *moor land*, over a strong clay soil. The expense of planting, as near as I can ascertain, cost you as follows, viz.:—

Your contract with Dicksons and Sim, of Hawick, was 6*l.* per acre for	64 acres
But the remainder having been done with larger plants, average fully 7*l.* per acre, for	110 acres
	174

I find the average cost of draining and fencing the above 174 acres, including the young quicks and guard fencing the same, amounts, as near as I can ascertain, to 4*l.* 12*s.* 6*d.* per acre, allowing the customary price for posts and rails out of your own woods. I am, Sir,

&c. &c. &c.

James Wilson, Esq. P. SCOTT.

Cost of planting, draining, and fencing 174 acres of land belonging to J. P. Wilson, Esq. of Sneaton Castle, referred to in the foregoing letter.

		£.	s.	d.
Planting 64 acres, at 6*l.* per acre, per contract . .		384	0	0
Do. 110 acres, at 7*l.* including plants and labour . . .		770	0	0
174		£1154	0	0
Expense of draining and fencing the above 174 acres, including young quicks, posts, and rails, amounting, as near as I can ascertain, to 4*l.* 12*s.* 6*d.* per acre.		804	15	0
		£1958	15	0

The quantity of plants in each acre, are 6969, which makes the total, 1,111,606. Each acre containing as under.

1000	oak	Making 6969 trees per acre, as before stated.
300	ash	
300	elm	
71	sycamore	
70	beech	
2614	larch	
2614	Scot's firs	

I hope the above statement will be understood by Mr. Aikin, as well as yourself, and prove satisfactory; and I can only say that every pains has been taken to ascertain the exact expense, as near as I possibly can.

I am, Sir,

&c. &c. &c.

P. SCOTT.

N. B. The hard wood has been planted in pits, and the soft wood nicked into the ground in the form of T.

I HAVE examined and surveyed the young plantations above mentioned, amounting to 174 acres, and certify the same to be correct, as stated by Mr. Peter Scott, steward for the Sneaton estate.

WILLIAM READMAN,
Land Surveyor and School Master,
Sleight, near Whitby.

No. III.

SEED FROM THE AMERICAN GRASS EMPLOYED FOR PLAT.

The sum of TWENTY GUINEAS, *being the premium offered, was this session given to Messrs.* COWLEY *and* STAINES, *of Winslow, Bucks, for raising Seed from the American Grass employed in Connecticut as the material of Fine Plat. The following communication has been received from the candidates on the subject.*

SIR, Winslow, Jan. 27, 1825.

WE again solicit permission to offer ourselves as candidates for the favour of the Society of Arts, &c. in consideration of our having, in the year 1824, produced 8¾ lbs. of ticklemoth grass seed, and otherwise conformed to the conditions attached to the offered premium, No. 23.

Our stock of grass was entirely derived from the seed you had the very great kindness to supply us with in the autumn of 1822. It was not weighed, but, as we should conjecture, the quantity might amount to 40 or 50 grains weight. The following account will explain the method of cultivation pursued.

Two large garden-pots were partly filled with horse-dung, and then nearly to the tops with rich mould; on this the seed was scattered as equally as possible, but with difficulty, on account of the seeds hanging together with much tenacity by their alæ.

By way of comparative experiment, the seed in one pot was covered about half an inch in depth with mould; on the other coal ashes were laid to a similar thickness.

In about three weeks the plants appeared in unexpected numbers, having a striking peculiarity of character, resembling small white spiculæ. They were kept in the open air, but in a sheltered situation, until the February following, when they had attained the height of one to two inches, and looked very green and healthy.

A piece of loamy soil, rich, deep, and dry, was then prepared with the spade, for the reception of the plants, which were set six inches apart, in rows, with twelve inches intervals. This was done on the 27th February, 1823, and the day or two following. The spot was afterwards kept tolerably free from weeds by hoeing and weeding, repeated several times in the summer.

In the May following, we had the pleasure of seeing our plants beginning to flower, so that we had reason to expect an immediate crop of seed. However, the grass by no means flowered generally; on the contrary, perhaps, not more than one plant in fifty bore seed, which was, to appearance, small in quantity, and was totally destroyed by the hares before it was ripe: they took it off (as they sometimes do wheat) about the middle of the panicle.

By the autumn the crop had assumed the form of a thick mat, and no further trouble was taken with it until the following spring, when it was again carefully weeded. It grew luxuriantly, and was ripe, we think, at the end of July, or beginning of August, by the criterion of the yellowness of the straw; it was therefore cut, made into small bundles, and dried in the sun.

After thrashing out the seed, much trouble was found in

cleaning it, as the chaff, &c. could only be separated by the hand, since it could neither be winnowed nor sifted, on account of the tendency it had to form masses, as lately alluded to.

The pot containing the coal-ashes evidently bore the best plants; so that it is probably a suitable manure. With respect to the difficulty of equally distributing the seed, might not a large, and well mixed, addition of mould, or of coal ashes, very much facilitate?

The quantity of land set was four poles, so that the produce of an acre would amount to 330lbs., provided it bore seed in proportion. The value of the seed we cannot speak to, as at present it has, in fact, no market price. Two agricultural societies in Germany applied to us, in consequence, we believe, of information derived from you, for some seed. We sent 3lbs., for which we charged 8s. per pound; offering, at the same time, to supply them with a large quantity of roots. The seed was transmitted through the medium of a very respectable house in London.

The Society will probably agree with us, from the apparent coarseness of the straw, in thinking that our soil is too rich for the purpose of raising this grass for fine plat. The colour, also, appears very indifferent; however, neither the time of cutting the grass, nor the after-management, were by any means such as would have been dictated by an intention of forming plat; and we hope these considerations will be received as a sufficient apology for the circumstance.

With respect to the selection of soil, we will mention a circumstance which appears to us to merit some attention, as calculated to assist in the choice. In August, 1823, whilst the ground was very wet, a narrow-wheeled waggon,

loaded with upwards of three tons of green poppies, passed over the plot of grass, and it was singular that in the next spring, the grass in the tracks of the wheels, and in the footsteps of the horses, assumed a widely different appearance to the other parts, being of a much darker green colour, and of more advanced growth. In fact, it bore the same relation to the parts which had received no pressure, as those parts of a meadow which have been accidentally manured by the cattle, do to the rest. It was evident enough that the condensation of the soil alone occasioned this luxuriance of growth, but whether it did so merely by checking the growth of those perennial runners which are produced in great numbers under-ground, or in a more direct way, was not so apparent.

A very small quantity of seed was reserved from the autumn sowing, of 1822, and committed to the ground with the plants in February, 1823, in two drills, twelve inches asunder. We learned nothing from this experiment, excepting that the species of grass is strictly biennial, as in the two rows not a plant flowered. The distance apart of the drills appeared very suitable, for the ground became fully covered before the harvest in 1824.

From these experiments we deduce, that whether the seeds of this grass be committed to the earth in the autumn, or in the spring, no crop of straw, or of seed, can be expected until the second summer following; a circumstance of much inconvenience, inasmuch as a crop must be lost, and a risk incurred of rendering the land foul. Should not this view of the subject suggest a cultivation of the ticklemoth, similar to that pursued with clover, ray grass, &c., that is, by sowing it with culmiferous crops. It appears to us even better adapted to such a purpose, as,

from having a large system of perennial roots, it would be less likely to perish from being over-shadowed; for the same reason, it would also bear a ploughing every spring, in moist weather, without the least injury to the crop; but on the contrary, with the advantages of getting rid of the annuals, particularly of our annual indigenous grasses. In this manner we have treated peppermint and spearmint for several years with the best success; both with the plough and the breast plough, turning up the slices of the latter.

Another method of expediting the cultivation of this plant may be suggested; we allude to the planting of roots in the first instance, a practice well known in the garden, and calculated to facilitate the cultivation of the grass, by saving a year. We are, Sir,

&c. &c. &c.

A. Aikin, Esq.
Secretary, &c. &c.

JOHN COWLEY, *Surgeon.*
WM. B. STAINES, *Surgeon.*

CERTIFICATES.

SIR, 22, Bush-lane, City, 22d Jan. 1825.

SOME time ago we took the liberty to apply to you respecting "the ticklemoth grass seed," when you were kind enough to refer us to Messrs. Cowley and Staines, of Winslow, Bucks; we now beg to say, that those gentlemen did send us, in September last, *three pounds* weight of the above seed, which we have sent to our friends on the continent.

We are, Sir,

&c. &c. &c.

A Aikin, Esq.
Secretary, &c. &c.

H. W. CAMPE & CO.

January 29th, 1825.

I HEREBY certify, that Messrs. Cowley and Staines grew, in the year 1824, eight pounds and three quarters of that species of poa, called ticklemoth, or New England grass-seed.

JAMES PREEDY,
Vicar of Winslow.

No. IV.

MATERIAL USED IN TUSCANY FOR PLAT.

The SILVER CERES MEDAL was this session presented to Mr. W. SALISBURY, Barossa-place, Brompton, for his information respecting the material employed in Tuscany for Fine Plat.

IT appears that specimens of the straw, with seeds of the plant, were, in 1819, brought to this country by Captain Roper, R.N., and were presented by him to H. R. H. the Duke of Sussex, President of the Society. Some of these seeds his Royal Highness gave to Mr. Salisbury, who sowed and obtained a crop from them in the following year. The plants being allowed to come to maturity, proved to be the *triticum turgidum*, a variety of bearded wheat, which seems to differ in no respect from the spring wheat grown in the vale of Evesham, and in other parts of England.

In the autumn of 1823, M. Fournier, of Geneva, a friend of Mr. Salisbury, being about to make a journey to Flo-

rence, was requested to make enquiries for him respecting the culture and subsequent preparation of the bearded wheat, as far as regards its application to the purposes of platting.

M. Fournier states that the bearded wheat is cultivated largely in Tuscany, both for food as well as for platting; and that he saw the plant grown for its straw alone in various parts of the Val d'Arno, between Pisa and Florence. The seed is thickly sown on a poor stony soil, on the bank of the river: when the crop is some inches high, it is mown, but not very close to the ground; this treatment subdues, more or less, the rankness of the plant, and the stems that shoot up are slenderer than before. If they are still too coarse, the crop is again mown, and so on to a third and even a fourth time, according to the vigour of the the plant. When the stems are sufficiently fine, they are allowed to grow; after the bloom is over, but while the grain is still very milky, the plants are pulled up and exposed to the sun on the sand of the river, care being taken to water them from time to time. When the straw is come to a proper colour, a very careful selection is made of it, according to its quality, and it is divided into several sorts, according to the size of the straw. The only part used is from the base of the ear a few inches down towards the first joint. The part between the first and third joints is reserved for common plat.

Specimens of the straw in its unprepared and prepared state, collected by M. Fournier, and given by him to Mr. Salisbury, were laid before the Committee.

No. V.

IMPROVED VARIETY OF RAY GRASS OR LOLIUM PERENNE.

The SILVER CERES MEDAL *was this session presented to* GEORGE WHITWORTH, *Esq., of Acre-house, near Caistor, Lincolnshire, for an improved variety of Lolium Perenne or Ray Grass, raised by him. The following communication has been received from the candidate, and seeds of the grass are in the Society's possession.*

SIR, London, March 9, 1825.

OBSERVING amongst the premiums offered by the Society of Arts, &c., a medal for the production of a specimen of *lolium perenne* possessing superior qualities to the kinds hitherto cultivated, I beg to offer a variety which I selected, and have grown for many years, and which, from the experience resulting from my particular enquiries into the properties and habits of the perennial ray grasses, I have found to be of more value than any other coming under my notice, being early in its growth in the spring, productive in its foliage, and giving, I believe, more nutritive matter than any other. This grass has also the advantage of yielding a fair quantity of seed, which ripens tolerably early, and may, from this circumstance, be profitably cultivated in some of the late ripening districts, or in situations of considerable elevation.

The aftermath, or autumnal produce, is equal to that of any with which I am acquainted, and this plant not only keeps its verdure in the winter months, but, in moderately open weather, always continues to grow at that season. To give some idea of the value of this ray grass, I beg to state that a field of upwards of twenty acres was sown down in April 1819, with about two pecks and a half per acre of seed. This piece of land was cropped for seed in 1820, 21, 22, and 23, four years in succession; in the autumn of the latter year, being then a full and fine sward, part of it was broken up for wheat, and the residue for oats, in the following spring, the whole being in a remarkably clean state. I believe it is pretty generally known that I have devoted much time to the cultivation of ray grass, and I trust that I may be presumed to possess some information on the subject. I feel it right to avail myself of the opportunity afforded by the Society of presenting the accompanying specimens and seed of my variety, and shall be happy to give every information that may be further wished connected with the subject.

I have the honour to be, sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEORGE WHITWORTH.

Certificates from neighbouring farmers who have tried the grass, assert that it is far superior to the usual varieties, both in the bulk of produce, early growth, and durability.

PAPERS

IN

CHEMISTRY.

No. I.

APPARATUS TO ENABLE PERSONS TO BREATHE IN THICK SMOKE, OR IN AIR LOADED WITH SUFFOCATING VAPOURS.

The LARGE SILVER MEDAL *and* FIFTY GUINEAS *were this session presented to Mr.* JOHN ROBERTS *of St. Helens, Lancashire, for his apparatus to enable persons to breathe in thick smoke or in air loaded with suffocating vapours. A set of the apparatus has been placed in the Society's Repository.*

THE subject was introduced to the notice of the Society, by a letter from Dr. Henry of Manchester, dated March 2, 1825, and addressed to the Secretary, of which the following is an extract:—

"This letter will be delivered to you by John Roberts, a poor collier, who has lately invented an apparatus for

enabling persons to enter without injury apartments filled with smoke and suffocating vapours. Of the contrivance itself, and its mode of operation, it is unnecessary that I should say any thing to you; but it is proper to observe that he has freely and unreservedly disclosed his invention, and exhibited its use, and that he looks for his reward to such public bodies, as, after scrutinizing its merits, may be satisfied of its utility.

"At the request of the Manchester Assurance Company, I was present at an experiment made in a close stove at an iron foundry, of the capacity of about 1120 cubic feet. About twenty pounds of cotton waste, made rather moist so that it might undergo a smothered combustion, were set on fire, and the doors (sliding ones of iron as high as the stove) were then shut: In a few minutes Roberts went in, and not long afterwards was followed by another person, son of the proprietor of the foundry. The doors were closed, and drawn asunder occasionally to hand in different articles, or to ascertain the safety of the parties. At these times, a lower current of cold and fresh air rushed in, and an upper current of smoke and acrid vapour rushed out, of so suffocating a nature, that standing close to the door, and being each time enveloped in it, I was satisfied that the upper state of the atmosphere within the stove must have been completely unrespirable. Roberts and his companion remained in about twenty minutes, at which time I caused a bottle of quicksilver to be emptied within the stove, about the height of the nostrils from the ground. The air thus obtained had not sustained a loss of more than one per cent. oxygen, or gained more than one per cent. carbonic acid. The noxious state of the air within the stove was owing therefore to the smoke and vapour with

which it was loaded, and not to loss of oxygen; but the suffocating effects of a small quantity of chlorine, diffused through a large quantity of air, prove that air may in this way be rendered as unrespirable as by abstracting its oxygen.

"Roberts is desirous to have his apparatus submitted in London to the test of experiment; and if this be done, I would beg leave to suggest that it will be well to ascertain whether he can enter an *up-stairs* apartment filled with smoke *from below*. In the experiment here, the stove was on the ground floor, and therefore very favourably situated for obtaining a renewal of fresh air near the ground, which appears quite essential to the security of his apparatus.

"I have suggested to him that a pane of mica, in front of the eyes, would not be so liable to be cracked by the contact of flame as glass; and that the spunge would be more effectual if wet with soap lees than with water."

The apparatus, see plate I., figs. 1. and 2., consists of a cap or hood of leather, with two orifices, filled up with strong glass or mica, to see through. The hood descends as low as the bottom of the neck, and is well wadded so as to be rendered air tight, or nearly so, when secured by the straps *b b b*. The wadding is carefully continued round the whole external edge of the nose, in order to prevent any air from passing thence to the eye-holes, and impeding the sight by depositing moisture on the inner surface of the glass. From the nose is continued a flexible leather pipe, *a a*, having a spiral wire inside to prevent it from being compressed. The pipe terminates in a trumpet-like piece of japanned tin plate *d d*, the open end of which is filled up with moist sponge, and covered externally by a

piece of coarse woollen cloth. At *c c* is a strap and buckle to secure the pipe to the lower part of the thigh, that it may not incommode the wearer by dangling about his legs.

By this arrangement, all the air that is drawn in at each inspiration passes through the pores, first of the moist cloth and then of the moist sponge. The consequence is, that all particles floating in the air are separated from it mechanically, and at the same time all those vapours or gasses that are in any considerable degree absorbable by moisture are separated by chemical action. The result of both these conjoint actions is, that air, mingled with smoke or sulphurous acid vapour, is purified from these substances, and rendered respirable provided the oxygenous portion of the air has not been materially diminished.

The candidate stated to the committee, that the first thing which suggested to him the possibility of separating the respirable air from smoke and other vapours with which it may be charged, was the relief which he found from covering his lips and nostrils with the edge of his flannel shirt while descending the shaft of a coal pit to his daily occupation, in which shaft two fires were burning for the purpose of keeping up a current of air through the mine. He next tried the effects of wringing out a woollen jacket in water, and closely covering his face with it: the advantage was decided, both in excluding the smoke and also in cooling the air. He afterwards tried a wet sponge with similar good effect. The invention or adoption of the hood naturally followed in his endeavour to combine these advantages with the free use of his hands and eyes.

He had observed (as others also have done) that in rooms which are filled, as it is called, with smoke, the stra-

tum of air near the floor is mixed with a smaller proportion of smoke than any other part, in confirmation of which it is well known that firemen and others, who are occasionally obliged to work in thick smoke, are able to remain in it much longer while on their hands and knees than when standing upright. Hence, in adapting his discovery to the use of firemen, he was led to annex a pipe to the head, descending as low as the middle of the thigh, in order to allow the wearer, while standing upright, to be drawing his supply of air from a less contaminated portion than that which enveloped the upper part of his body, while, at the same time, it should be no material embarrassment to him in a stooping posture.

The secretary and several members of the Society were invited to witness an experiment on the efficacy of Roberts's invention, which was made at the house of the Mechanics' Institution, 29, Southampton-buildings, on the 25th of March.

In the area of the lecture room, the walls alone of which were at that time finished, a chamber was constructed of boards about fifteen feet high. A short ladder was placed in it, so as to enable a person to reach the upper part, and two windows were inserted about four feet from the ground: a hearth of bricks supported the combustibles from which the smoke was to be obtained.

Moist wood shavings, wet hay, two pounds of brimstone, and a shovel full of rosin, were set fire to, and the door was shut. In a few minutes the chamber seemed full of smoke: on opening the door a quantity of smoke flowed out, and in a few minutes the lower part of the room, to the height of about 2½ feet, was clear, while a dense cloud filled all above. The smoke was intensely suffocating, and produced

violent coughing on being inspired. The door being then shut the cloud of smoke descended nearly to the floor, so that some firemen, who had entered the chamber, were only enabled to remain there by crouching almost on their bellies.

These preliminary experiments being made, more fuel was put on the fire, and Roberts, with his apparatus on, entered the room, walking erect. The temperature of the room was at this time 68° *Fahr.*, that of the external air, being 48°. In ten minutes the temperature had risen to 87° in the upper part of the chamber. At 19 minutes the candle on the window-board, which had been burning very dim, went out; at 20 minutes the temperature was 91°, at 22 minutes it was 104°, at 30 minutes the candle fell down in a melting state, the temperature being 115°. At 36 minutes Roberts came out of the chamber, having been for the last quarter of an hour on the ladder in the upper part of the chamber, and quite invisible from the density of the smoke. When he came out he was, as might be expected, very hot, and his pulse was 174, but he did not appear exhausted: he took some coffee, and in about half an hour his pulse had subsided to its ordinary state.

The air, exclusive of the smoke and sulphurous acid floating in it, differed from common air only in containing two per cent. more of carbonic acid, and two per cent. of oxygen, thus showing that it is unfitted for respiration only by the smoke and vapours floating in it.

A second experiment was made on the 2d of April, with a perfectly similar and equally satisfactory result, in presence of several scientific persons, and of some of the managers or directors of fire offices. Of this experiment

the following are the details, as stated in the *Mechanics' Register*, No. 24:—

"The fire having been previously prepared, and an ample supply of combustibles placed in the temporary room used on the former occasion, Roberts put on his apparatus, and entered the apartment at eight minutes after two o'clock, at which time the thermometer on the outside stood at 54°. About three pounds of sulphur, in addition to other combustibles, were consumed during the experiment, the sulphur being placed in an iron pan, to prevent it from escaping combustion by falling to the floor of the apartment. The density of the cloud of noxious smoke, and the heat of the room, increased as before, till the temperature indicated by the thermometers fixed in different places was as follows:—

At the ceiling	158
In the centre	101
Near the floor	68

One of the workmen entered the room upon his hands and knees during the experiment, but on attempting to raise his head higher than about a foot from the ground, the suffocating sensation compelled him to quit the chamber with precipitation, after remaining there only two or three minutes. Roberts, in the mean time, traversed the room in an erect posture, supplied the fire with additional combustibles, and occasionally ascended the ladder, without feeling any inconvenience, except from the heat; and after having been enveloped in the smoke exactly thirty-nine minutes, and afforded to every spectator a satisfactory demonstration of the efficacy of his invention, he

quitted the apartment at thirteen minutes before three o'clock, and disencumbered himself of his apparatus in one of the lower rooms of the Institution. Mr. Pettigrew here examined his pulse, which was at 160, but subsided to 114 in about twenty minutes, and soon afterwards resumed its ordinary motion."

No. II.

IMPROVED MELTING POTS.

The SILVER VULCAN MEDAL *and* TWENTY GUINEAS *were this session presented to Mr.* L. ANSTEY, *of Drummond-crescent, Somers-town, for his Improved Melting Pots for Iron and Brass Founders. Samples of the Pots are in the Society's Repository.*

27, Drummond Crescent,
17th March, 1825.

SIR,

I HEREWITH send a melting-pot of my manufacture, which, from several years' experience in the melting of cast-iron, I find to answer the purpose better than any which I have been enabled to procure. They are composed of two parts Stourbridge clay, and one part of the hardest coke, well ground and tempered together. Any further explanation I should be happy to give, if required.

I am, Sir,
&c. &c. &c.
L. ANSTEY.

A. Aikin, Esq.
Secretary, &c. &c.

The following particulars were stated by the Candidate to the Committee.

THE composition employed by him, and first used six years ago by his late father, is the following:—Take two parts of fine ground raw Stourbridge clay, and one part of the hardest gas coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well (if the coke is ground fine the pots are very apt to crack). The pot is moulded by hand on a wooden block, as shown Plate II. fig. 4, in which *a* is the bench; *b b* two uprights, supporting a cross board *c*, in which is a hole for the reception of the stem of the core; *d* the core, with its stem *e*, which passes loosely through the cross board *c*, and ends in a pin that turns in a hole in the bench; *f* is a gauge to regulate the thickness of the melting-pot, as shown by the dotted lines; *g* is a cap of linen, or cotton, placed wet on the core before the clay is put on; its use is to prevent the pot from sticking partially to the core while it is taking off; the cap adheres to the pot only while wet, and may be removed without trouble or hazard to the pot when dry: *h* is a wooden bat, to assist in moulding the pot; when moulded they are carefully dried at a gentle heat.

The smaller pots hold about twenty pounds of cast iron, and can be afforded for ten pence a-piece; the larger ones hold forty pounds, and may be afforded for fourteen pence.

A pot, dried as above, when wanted for use, is first warmed by the fire-side, and is then laid in the furnace

with the mouth downwards (the red cokes being previously covered with cold ones, in order to damp the fire); more coke is then thrown in, till the pot is covered, and it is then brought gradually up to a red heat. The pot is then turned, and fixed in its proper position in the furnace, without being allowed to cool, and is then charged with cold iron, so that the metal, when melted, shall have its surface a little below the mouth of the pot. The iron is melted in about an hour and a half, and no flux or addition of any kind is used. A pot will last for fourteen or even eighteen successive fusions, provided it is not allowed in the intervals to cool; but if it cools it probably cracks. These pots will bear a higher heat than others without softening, and will consequently deliver the iron in a more fluid state than the best Birmingham pots will.

The cavity of the furnace employed by the candidate is eleven inches square in superficial area, and consists in depth of eleven rows of bricks, made of Stourbridge clay; the wind hole is four inches square, and is placed three inches below the top; the bars are either of wrought or cast iron, supported on wrought iron bearers. The ash-hole is ten courses of bricks below the bars, and the chimney is rather a high one. The sides of the furnace wear away by the heat, so that in the first week the cavity becomes two inches wider than at first. It is then brought up to its original width, by a lining of glass-cutters' mud, which consists of fine sand mixed with particles of glass; and this is renewed twice a week. The cavity of the furnace being only eleven inches across, and seven inches of that being occupied by the melting pot, it is of course necessary that the coke used as fuel should be broken into small pieces, not larger than a walnut.

At a subsequent meeting of the committee, D. Campbell, Esq., who had been requested to make some experiments on Mr. Anstey's pots, reported that he had melted a charge of iron in one of the smaller pots, placed in a powerful wind furnace; the pot remained sound.

Into a second pot was put a Wedgewood crucible, inclosing a blacklead one, and that a Cornish one; a cover was luted on, and the pot thus charged was kept for three hours in the same wind-furnace, and was brought unopened to the committee. On examination, Anstey's pot appeared to be quite entire; its shape had not altered, nor was there any change of texture, indicating an approach to fusion: it resisted several blows of a hammer before it broke. Of the crucibles inclosed in the pot, Wedgewood's had cracked to pieces, and the texture had become compact and semi-vitreous; the blacklead one had softened considerably, and had undergone a change of shape; the Cornish one was unaltered in shape, and nearly so in texture, having only become somewhat more compact.

A third pot had been exposed for an hour to a very high heat in the same furnace, being placed on a brick of Stourbridge clay; several small crucibles had been put into it, and a cover had been luted on. On examination, the pot had undergone no change, except that the slag of the coke, which was used as fuel, had glazed it over: beneath the glaze there were no signs of fusion, nor even any change of texture. The brick support was in the state of porcelain jasper; the cover had begun to sink in: the Cornish crucible which was inclosed showed a beginning of fusion; the Chelsea crucible was bubbly, and half melted.

An empty five-inch real Hessian crucible had been heated in the same furnace as strongly as possible: it had not sunk down at all; on being broken, the texture appeared porcellanous, with interspersed air bubbles, showing a beginning of fusion.

A white Birmingham pot was first annealed, and then heated (empty) in the same furnace. On examination by the committee, it was found to be cracked across the bottom, and its texture had become that of porous porcelain jasper.

Another white Birmingham pot was treated in the same manner as the former, and on examination presented several small cracks, and a porcellanous texture, but less porous than the preceding.

One of Anstey's large pots, in which five charges of iron had been melted, was shown to the committee: the form was unaltered; it withstood several blows of a hammer before it broke; the texture was granular, without any commencement of porcellanous.

No. III.

IMPROVED ELECTRO-MAGNETIC APPARATUS.

The LARGE SILVER MEDAL *and* THIRTY GUINEAS *were this session presented to Mr.* W. STURGEON, *8, Artillery-place, Woolwich, for his Improved Electro-Magnetic Apparatus. A set of which has been placed in the Society's Repository.*

MR. MARSH'S apparatus, for the same purpose as Mr. Sturgeon's, was rewarded by the Society in the session before last. The battery, consisting of plates presenting eight surfaces of about a square foot each, and weighing from twelve to thirteen pounds, was the smallest that had at that time been applied to electro-magnetic researches. The rest of his apparatus, with few exceptions, was such as had already been used by Ampére, Sir H. Davy, Mr. Barlow, Mr. Faraday, and others, fitted together in a very convenient way, and stowed in a box, which, with the battery, made a package sufficiently portable.

Mr. Sturgeon's apparatus is even more portable than Mr. Marsh's, and (the moving parts being at the same time larger) is better fitted than that for the use of the lecturer.

The battery is similar in construction to Professor Hare's calorimotor, and consists of two fixed, hollow,

concentric cylinders of thin copper, having a moveable cylinder of zinc placed between them. Its superficial area is only 130 square inches, and it weighs no more than 1lb. 5oz. It is moveable on an upright metallic rod, like a laboratory lamp, and may therefore be adjusted to any convenient height. It will not hold more than about a pint of liquid, which should be composed of one part nitric acid, and eleven parts water: it is charged with the greatest ease, by merely pouring in the liquor from a common lipped jug. A farther advantage of the construction is, that after every experiment the liquor may be returned to the jug, while preparations are making for the next, by which the battery, when wanted, is in a state of high activity, and is undergoing no deterioration in the interval between one experiment and another.

A farther point of novelty is, that Mr. Sturgeon has very judiciously chosen to have a small galvanic power, assisted by a strong magnetic power, rather than the reverse, as is usually the case. This has enabled him greatly to economize in the size of his battery, and in the cost of acid to excite it, while the increased magnetic power is obtained at a small first expense, and needs no renewing.

Sir, No. 9, Artillery-place, Woolwich.

The science of electro-magnetism, although so generally interesting, yet (comparatively speaking) appears to be very little understood. This latter circumstance is probably, in a great measure, owing to the difficulty of making the experiments, and the great expense attending

the process; for, besides the first price of a large battery, considerable expense in acid must always attend its excitation, whenever an experiment is attempted. Large batteries are always attended with difficulty of management, and the great quantity of hydrogen evolved during the process renders the use of them extremely inconvenient to the operator. These are evidently great obstacles to the experiments being often repeated, and to the science being generally known. Another, and perhaps no less obstacle to the advancement of this interesting science, is, that the experiments being hitherto exhibited on so small a scale, are by no means calculated to illustrate the subject in public lectures; for when the experimenter succeeds even to his wishes (which is not frequently the case), the experiment can only be seen by a very near observer, and the more distant part of the auditory are obliged to take for granted what they hear reported (from those persons who are more favourably situated), of some of the most interesting facts, which they, from their distance, are unable to witness.

With a view of removing, in some measure, these apparently formidable obstacles in the progress of this infant science, I have devoted a considerable portion of time, labour, and expense, in repeating several of the experiments, under various circumstances, and with various forms and sizes of batteries. I have likewise instituted a series of experiments, for the purpose of discovering, if possible, if any particular ratio of galvanic and magnetic power was absolutely necessary to be observed in the process of electro-magnetism. If no particular proportion of those two powers was essential, then it appeared highly probable that an increase of magnetic power might com-

pensate for a deficiency of the galvanic, and thereby render the use of large galvanic batteries quite unnecessary, an object which I considered both interesting in its nature, and, by reducing the expense, and facilitating the process, exceedingly desirable to the experimenter; and I am happy to state, that my labours were no ways abortive, for instead of electro-magnetic phenomena depending on powerful galvanic, and feeble magnetic force, as had till then been practised, I found, during that inquiry, that the galvanic force may be reduced to almost any degree, provided the magnetic be sufficiently powerful. This discovery led me to the use of powerful magnets, and small galvanic batteries, for with small magnets the experiments can never be made on a large scale, although the galvanic force be ever so powerful; and as minute and delicate experiments are not calculated for sufficiently conspicuous illustration in public lectures, I considered that an apparatus for exhibiting the experiments on a large scale, and with easy management, would not only be well adapted to the lecture room, but absolutely valuable to the advancement of the science. Upon this principle I have constructed a complete set of instruments, which, from their superior magnitude, and peculiar arrangement, are, in my humble opinion, and by the certificates I have been honoured with, are, in the opinion of gentlemen whose judgment I presume will ever be held in the highest estimation, well adapted for the illustration of the subject, either in the private study or public lecture room.

It will be understood from what I have already stated, as well as from an inspection of the instruments, that the mode which I have taken for the production of electro-

magnetic phenomena is more simple in its management, less expensive in the process, better calculated for the illustration of the subject, and the reverse of that which has hitherto been used, and which, by its almost entire dependence on the tedious and expensive process of galvanism, has considerably retarded and obscured this new and interesting science; for whenever an experiment was not attended with the anticipated success, the failure was generally attributed to an insufficiency of galvanic power; and in order to increase the effect, it appears that the experimenter had no other means of accomplishing his object, than by augmenting the power of his battery, or by reducing the size and increasing the delicacy of his other apparatus, the magnetic power being either entirely lost sight of, or regardlessly neglected, as if no ways materially concerned in the process.

I have found, however, by the above-mentioned course of experiments, that the magnetic force is as essential as that of galvanism to the development of electro-magnetic phenomena; and the apparatus which I now submit to the attention and impartial consideration of your valuable Society, acting on the principle of powerful magnetism and feeble galvanism, will, I trust, be found more eligible and efficient than any other that has yet been brought before the public.

I am, Sir,

&c. &c. &c.

W. STURGEON.

A. Aikin, Esq.
Secretary, &c. &c,

CERTIFICATES.

Royal Military Academy, Woolwich Common,
9th May, 1825.

SIR,

As I understand that Mr. William Sturgeon proposes to submit his galvanic battery and electro-magnetic apparatus to the consideration of the Society for the Encouragement of Arts, &c., I take the liberty of recommending them to your favourable consideration, although I have not the honour of being personally known to you. Since the first discovery of the action of the galvanic circuit on the magnetic needle, I have witnessed all the principal phenomena connected with electro-magnetism, as exhibited by batteries and apparatuses of different constructions, and have no hesitation in saying, that the battery and apparatus of Mr. Sturgeon are most admirably calculated for exhibiting all these phenomena in the most striking manner, and that they afford peculiar facilities for investigation in this most interesting science. The expense attending the purchase and use of large galvanic batteries, the difficulty of keeping them in powerful action, and the inconvenience of using them, except in laboratories, must all tend to retard the progress of a science, which has opened a new field for inquiry; and as the battery and apparatus of Mr. Sturgeon are free from all these objections, I consider that, by rendering them public, the cause of science is promoted, and that he is deserving of every encouragement for their invention and successful application.

I am, Sir,

&c. &c. &c.

S. H. CHRISTIE, M.A.

A. Aikin, Esq.
Secretary, &c. &c.

Royal Military Academy, Woolwich,
May 9th, 1825.

SIR,

I BEG leave to introduce to the favourable notice of the Society, Mr. William Sturgeon, a resident of this town, who has for some time devoted himself most sedulously to the improvement of apparatuses for the development and exhibition of the properties of electro-magnetism. He wishes to solicit the patronage of your valuable Institution to a new *battery* of his invention, which, while it is very far smaller than any other of which I have heard, is very efficacious, and at the same time remarkably calculated to facilitate the experiments. Mr. Sturgeon has also, in my judgment, greatly improved several other classes of apparatus employed in this interesting department of research, and constructed them upon a scale which renders the experiments susceptible of pleasing, and successful exhibition to a large auditory. He will regard himself as highly honoured, by permission to exhibit them before a committee of the Society; and I cannot but believe, that if he be so honoured, his talents and ingenuity, tending, as they have done, to most curious and pleasing results, will entitle him to favourable consideration and an appropriate reward.

I am, Sir,

&c. &c. &c.

OLINTHUS GREGORY,
Professor of Mathematics.

A. Aikin, Esq.
Secretary, &c. &c.

HAVING read the above certificate of Dr. Gregory, and that of Mr. Christie, I have no hesitation in adding my testimonial to every thing there stated.

PETER BARLOW.

Reference to the Engraving of Mr. W. Sturgeon's Electro-Magnetic Apparatus.—Plates III. *and* IV.

PLATE III. Fig. 1. A perspective view of an apparatus to show the revolution of a magnet round its own axis. *a a* the two galvanic apparatuses on their stands *b b*, they are acting on the magnet N S, by means of the connecting wires *d d d d*; both their copper poles C C are applied to the equator *e* of the magnet, while the zinc pole Z of one is applied to the north pole N, and the zinc pole Z of the other is applied to the south pole S of the magnet. A wire *f* is soldered on to the magnet, and bent down at one end to dip into the circular trough *e* to form the equatorial connection: and as all the connections are made by mercury and amalgamated wires, the end of this wire is amalgamated, and mercury put into the trough: all the little cups Z and C are also amalgamated at the bottom, and contain mercury; the bottom wires of the zinc and copper poles are likewise amalgamated to dip in connecting cups when wanted. The magnet has brass wire centers on which it turns, that at the north pole stands in a cup Z with mercury; and the other at the south pole enters the amalgamated hollow in the screwed end of the upper connecting cup Z. When the connections are made, as above described, on pouring in dilute nitric acid into the troughs *a a*, the magnet will revolve in the way shown by the arrow; but on changing the connections, by applying the copper wires to the poles, and the zinc ones to the equator, it will revolve the contrary way; here the magnet only forms the connection between the electric poles, and revolves around, or with the current which is conducted by it. *g g g* is the stand which

supports the magnet; the equatorial trough *e* is made moveable on the pillars *g g*, and is fixed by the screws *h h*.

Fig. 2. A bird's-eye view of the same, without the stands *b b* and *g*. The galvanic troughs *a a* are copper, and cylindrical, having a smaller split cylinder of copper, soldered within to increase the copper surface; the intermediate cylinder in each trough is zinc, it has three cork feet, cemented to the bottom edge to prevent contact with the copper, and two pieces of cork *i i* cemented at top for the same purpose; *e* the annular trough.

Fig. 3 shows the magnet separate.

Fig. 4. A wooden cover; one is fitted to each trough *a a*, to prevent the ebullition of the acid from damaging the apparatus.

Figs. 5 and 6. A side and front view of a circular metal disk, made to revolve between the poles of a horse-shoe magnet; the disk is amalgamated round its edge, and dips into a little mercury contained in a hollow *j* of the stand, the centers *k k* on which it turns, and the hollows that receive them in the forked support *l l* are amalgamated; the screw *m* allows the disk to be adjusted, and fixed so as only just to touch the surface of the mercury. A horse-shoe magnet N or N S shown by dotted lines, is laid on the stand, then one of the troughs *a* of fig. 1, is to be adjusted on its stand *b*, till its bottom wire Z dips into the connecting cup Z, forming the zinc communication, and a connecting wire *d* with bent ends, is to dip into the copper connecting cup C of the trough, and into the cup *c* of the disk; the communication of the poles being thus made, (the current passes from Z, through the mercury *j*, into the edge of the disk, and through its centers *k k* into the fork *l l*, and up to the cup *c*) the

disk will then revolve as shown by the arrow. By reversing either the poles of the magnet, or the electric poles, the revolution of the wheel is reversed; but if both are reversed, the revolution will continue in the same way as at first. The six rays are painted on the disk, merely to render the revolution visible at a greater distance.

Fig. 7. A stand supporting a needle between two conducting wires *o o* and *p p* to show the different effect of electricity on the needle when passing above or below it; the cup Z is common to both, but the other ends have each a separate cup C C: when the electric current passes along the upper wire, *p p* the needle takes the position as shown in fig. 8; but on lifting the connecting wire out of the cup *p* C and putting it into the cup *o* C, the current passes through the under wire *o o*, and the needle immediately goes round to the position indicated in fig. 9; then if you watch the motion of the needle, and keep alternately transferring the wire out of one cup into the other, keeping time with the needle, you may bring it into the most rapid revolution that you can possibly keep time with.

Plate IV. figs. 19 and 20, show a side and front view of a dipping needle, mounted between two wires, *o* and *p*; they are here placed in the direction of the dip, but the quadrant *i* allows them to move one quarter round, or to the equator of the magnet, as shown by dotted lines. In their present position the needle will deviate, as figs. 8 and 9, plate III.; and it will be seen the needle cannot take a position quite at right angles to the wire, owing to the terrestial magnetism drawing it on one side; but when the wires are carried round to the dotted position, fig. 19. plate IV., the needle remaining as it was, so as to be at

right angles to each other, then on passing the current from Z through the wire *o o*, no effect will appear to take place, the needle is only more confirmed to its position, but on passing it through *p p*, the needle goes round, and dips with its south pole. The wire passes through the wooden cup Z, but the two ends of it *p* and *o* only just enter their respective wooden cups C C; these wooden cups are placed at an angle of 45° to the horizon, so that in either position they are similar, and will hold mercury enough to make the contact.

Plate III. fig. 10, shows an arrangement for making a cylinder revolve, by applying a battery of magnets to the outside. The cylinder and stand are in section to show the support.

Fig. 11 is a bird's-eye view of the same apparatus, the cylinder being removed, and its place shown by a dotted circle; the middle portion *q* contains mercury, which also flows in a very narrow arm to the side where the magnets are placed. The sides of this narrow arm are so low that the convex surface of the mercury rises above them, and the edge of the cylinder, which is amalgamated, passes over, as shown by the dotted circle, and keeps in contact with the convex surface of the mercury without touching the sides of this little trough. The cylinder, fig. 10, has a sharp point in its crown, by which it hangs freely on the top of the central wire *r*; this wire fits into a pipe or hole *s* in the stand, and the mercurial trough *q* being varnished, prevents this axis from forming a communication. There is also a little connecting cup *t* for mercury on the top of the cylinder, into which the screw of the upper connecting cup C dips just enough to touch the mercury; *u v* is a wooden stand holding six magnets, the

north poles of which are placed near the cylinder on the side that dips into the mercury; then on making the galvanic communication with Z and C, the current passes through the wire of Z into the mercury *q*, and out of the mercury up that side of the cylinder opposed to the magnets, and meets the copper pole C at top. Now the magnets are continually propelling that portion of the cylinder which forms the connection, and as the succeeding portions continue to form the connection with the mercury, only opposite to where the magnets are placed, they are as continually propelled, and thus a revolution is produced; the arrows show the direction of the motion, and changing the poles changes the direction.

Fig. 12. *w w* shows the arm which supports the upper conducting cup, it fits into the pipe *x*, which is screwed to the foot.

Figs. 13 and 14. A front and side view of a stand with two connecting cups Z and C made of wood, in which the bent iron wire wound round with copper wire is supported by the two copper wire ends. On making the galvanic connection through the copper wire, the iron wire becomes a strong horse-shoe magnet, and will support a heavy bar of iron as *y* fig. 14; but on lifting the connecting wire *d* fig. 13, out of the cup Z, the weight immediately drops, and on restoring the connection, the power is restored, then if you change Z for C, it will change N for S, or if you only wrap the copper wire about the iron wire, as a right threaded screw instead of a left one, as in the drawing, it will change N for S. This is explained by what takes place in figs. 7, 8, and 9.

Plate IV. fig. 1. Another copper wire fitting the stand,

Plate III. fig. 13. This arrangement communicates

magnetism to hardened steel bars, as soon as they are put in, and renders iron wire within it magnetic during the time of action, it only differs from fig. 13 in being straight, and thereby allows the steel or iron bars to slide in or out.

Plate IV. fig. 2 shows the revolution of two magnets round two similar electrified wires *g g*; a stand supported by three pillars *h h h*; *e e* two annular wooden troughs, one is shown separately in section fig. 3; the neck *i* fits easily into corresponding holes in the stand *g g*: *j j* two standards with pointed tops; N S, S N, the two magnets are bent as fig. 4. and have hollows in the middle, by which they swing on the standard points *j j*: fine copper wires *k k* are twisted tight on each magnet, and go loosely round the standards *j j*; they serve to keep the magnets upright; *l* a brass standard fixed at the back of the stand, and bent forwards at top, where it is split to receive the flat piece *m*, which is secured by the screw *o*; this flat piece carries the bent wire *p p*, having cups C C on its shoulders, and points at bottom, to enter without touching the cups *q q*; *f f*, figs. 4 and 5, are bent wires, cemented on the middle of the magnets; these pass through the cups *q q*, and dip into the troughs *e e*, fig. 2; into these, as well as into the cups C C and Z Z, mercury is placed to form the connection, then bringing the galvanic troughs *a'a*, and dipping the zinc poles into Z Z at the equators of each magnet, and uniting the copper poles *c c*, by the wires *d d*, to the upper cups C C, the circuits are completed, and the magnets will revolve (as shown by the arrows) around the wires *p p*.

Fig. 6 a horse-shoe magnet, mounted with two mercurial troughs *r r* (fig. 7. shows one separate), *t t* two

cylinders suspended on the ends of the magnets, by points within their crowns under the cups *v v*; their bottom edges are filed away, leaving only four points (as fig. 8) to touch the mercury, by which means the friction is much lessened. The troughs are adjusted by the screws *u u* so as to bring the mercury just in contact with the points of the cylinder; the screw points of the upper cups C C just touch the mercury in the cups *v*. Upon making the communications as before with the cups Z Z and C C, the cylinders will revolve as shown by the arrows.

Fig. 8, *w* is one of the wires which holds the upper cups C C; the bent end *w* twists into a hole in the side of the trough *r*, and thus supports the wire when it is necessary to turn it over on one side previous to removing the cylinders.

Fig. 9 shows a stand on which a rectangular wire is suspended on one of its sharp pointed and amalgamated ends, which is here the copper end; the other or zinc end, although tied to it, is kept separate by the silk thread passing between them, this zinc end dips into the little mercurial cup *x*, from which the small wire *z* descends to the cup Z at bottom, the cup C is united to the standard, (the cup *x*, and the part of the standard that rises through it, is well varnished to insulate the mercury from the standard); on making the zinc and copper communication with these cups the circuit is completed through the rectangular wire, and it will then take the position east and west; but in changing the communication the west side will go round to the east.

Fig. 10 shows another rectangular wire through which the circuit is completed; the side *y* when offered to the west side of fig. 9 repels it, the current being in con-

trary directions through them, as shown by the arrows, but it will attract the east side, the two currents being then alike.

Fig. 11 is a compound or double horse-shoe magnet, fixed upright in a block of wood *a a*. Two brass tubes shown in section *b b*, are fixed in the board *c c*, and fit on over the magnet, making them appear as two pillars; they are secured to the bottom block *a*, by two screws *d*. On the top of these are fitted the two circular mercurial troughs *e e* (they are shown separate in figs. 12 and 13). The upper cups C C have loops, or eyes, at the bottom of their screws, which are amalgamated as well as the hooks of the wires on which the pith balls *f f* are placed. The lower ends of the wires dip into the mercury in the troughs *e e*: on making the communication, or circuit through Z C, Z C, the wires will revolve as shown by the arrows. The upper cup C is insulated from the arm *w*, fig. 13, by the piece *u* being of hard wood.

Fig. 14 shows one of a pair of troughs fitted to the same magnet, it has a fixed arm or arch *g*, through the top of which passes a cupheaded screw, also a smaller arm with the stud *h*, to hang on the top of the pillar *b*, fig. 11. The trough is varnished, to enable it to hold dilute acid. On the stud *h* hangs the zinc cylinder shown separate fig. 15. It is adjusted by bringing the screw in the arch *g* to touch the mercury in the little cup, then the copper cylinder, fig. 16, is hung on the screw-head by its amalgamated point, completing the circuit through the screw of the fixed arch *g*; on filling these vessels with dilute acid the zinc and copper cylinders will revolve as shown in fig. 17.

Fig. 18 shows two of the connecting wires separate, three or four pairs of each of these are required.

These figs. are nearly one-fifth of the real size, and it will be seen that the magnetic power is very great in proportion to the galvanic power.

No. IV.

MODE OF PRESERVING LIME-JUICE.

The THANKS *of the Society were this session voted to Captain T. M.* BAGNOLD, *for his Experiments on preserving Lime-Juice.*

IT is well known that the juice of lemons, or of limes, expressed from the fruit, will in a short time, especially if kept warm, become mouldy, and unfit for use as an article of food; and that the final result of this spontaneous change is the destruction of the acid itself. The acid may, indeed, be separated from the other matters with which it is naturally mixed; but in so doing all the odour and flavour of the native juice are also destroyed, for pure crystallized citric acid is wholly inodorous, and to the taste simply acid.

The effect of pure citric acid in preventing or mitigating the severity of sea-scurvy is greatly inferior to the recent juice; and in many of our circumnavigations, lemon or lime-juice, mixed with a small proportion of rum, about one-tenth, has been found to keep for a considerable time in tropical countries, and to be very efficacious in preserving

the health of the crews. In some cases, however, this addition of spirit is by no means desirable.

In April, 1824, Captain Bagnold produced to the committee a specimen of lime-juice, which had been prepared in Jamaica in the preceding September, according to his directions. The juice having been expressed from the fruit was strained, and put into quart bottles: these having been carefully corked, were put into a pan of cold water, which was then by degrees raised to the boiling point. At that temperature it was kept for half an hour, and was then allowed to cool down to the temperature of the air. The process, therefore, was, in substance, only the same as that which has been long practised in this country for preserving green gooseberries, and other fruits, for domestic use. A bottle being opened by the committee, the juice was in the state of a whitish turbid liquor, with the acidity and much of the flavour of the lime; nor did it appear to have undergone any alteration.

In March, 1825, some of the same juice, which had been examined the year before, and which had since only been again heated and carefully bottled, was laid before the committee. It was still in good condition, retaining much of the flavour of the recent juice.

Hence, it appears, that by the application of the above process, the addition of rum, or other spirit, to lime or lemon juice, may be avoided, without rendering it at all more liable to spontaneous alteration.

No. V.

ETCHING AND CLEANING ALABASTER.

The LARGE SILVER MEDAL *was this session presented to Mr.* HENRY MOORE, *of Green Hill, near Derby, for his mode of* ETCHING *and* CLEANING ALABASTER. *A vase so etched has been placed in the Society's repository.*

SIR, Green Hill, Derby, March 16, 1825.

I SEND you an alabaster vase, ornamented by a process which I discovered some time ago, and by which process soiled alabaster sculptures may also be completely cleaned, and rendered equal to new. I beg you to lay the article before the Society for the encouragement of Arts, Manufactures and Commerce, together with the annexed account of the process by which the ornament is effected.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. HENRY MOORE.

Taking advantage of the well-known fact that gypsum, or alabaster, or sulphate of lime, (for these are only three names for the same thing), is perfectly soluble in 500 parts of cold water, Mr. Moore has adopted the following process.

He covers the ornament, and all those parts that are not to be corroded, with a composition that will resist water. Wax, dissolved in spirits of turpentine, and mixed with white lead, may be used with a camel-hair pencil; or turpentine varnish, with a little animal oil and white lead, and will be found to work more freely than the wax. Spirits of turpentine must be used in pencilling with these compositions. The use of animal oil is to prevent the varnish from becoming very hard, which would render its removal, after corrosion, extremely difficult. The ornament, and other parts which are intended to be preserved, being completely covered with the composition, it is suffered to remain a few hours to dry. The article is then put into a vessel of rain water, in which it must remain forty-eight hours, or longer, according as the ornament may be required to have more or less relief. When the corrosion is completed, the varnish or wax must be removed with spirits of turpentine, which may be applied with a bit of sponge, and then be wiped off with soft rags.

The article, being made quite clean, is now rubbed over with a soft brush, dipped into finely-powdered plaster of Paris, and is applied in the dry state. This powder fills the pores of the corroded parts, giving a certain degree of opacity, similar to that which is left from the tools of the sculptor. It forms a good ground that contrasts well with the ornament, and makes it appear with greater advantage than if left merely in the corroded state.

The alabaster of which the vase is made was procured from a quarry at Chellaston, about four miles from Derby.

To clean Alabaster Sculptures.

Spots of grease are first to be removed with spirits of turpentine; the article is then immersed in water, where it is suffered to remain about ten minutes, or, perhaps, a little longer, if the thing be very dirty; it is then rubbed over with a painter's brush, suffered to dry, and then treated with plaster of Paris as above, when the article will be found perfectly clean, as if just from the hands of the sculptor.

A piece of sculpture that would take several days to clean by the usual way, with fish skin and Dutch rushes, is, by this process, completed in half an hour.

No. VI.

BRITISH OPIUM.

The Society have for some years offered premiums to encourage the cultivation of the white poppy in this country, for the purpose of obtaining opium from it. The communications received on this subject from Mr. Young, of Edinburgh, from Mr. Jeston, and from Messrs. Cowley and Staines, are inserted in the 37th, 38th, 41st, and 42d volumes of the Transactions. From these it appears, that in common seasons, and by proper management, the produce per acre of opium is such as to yield a fair return of profit to the grower. The opinions of professional men have also been published, showing that British opium, in its medicinal properties, is at least as

efficacious as the best in the market, namely, that from Turkey. It still remained, however, a desideratum, to ascertain, by a careful comparative experiment, the relative proportions, in British and foreign opium, of that vegetable principle called morphia, to which the effects of this drug on the human constitution are owing.

Mr. H. Hennell, a member of the Society, and chemical operator at Apothecaries' Hall, where the extraction of morphia from opium forms part of the regular business of that great establishment, was requested to undertake this examination. Opium prepared by Messrs. Cowley and Staines was furnished by the Society for this purpose, and the result was, that 700 grains of dried Turkey opium yielded 48 grains of morphia, and an equal quantity of dried English opium, yielded 53 grains of morphia.

The process pursued with each was, to infuse the opium in dilute acetic acid, and then to decompose the acetic solution by ammonia: the precipitate thus obtained was digested in hot alcohol, and the morphia was obtained therefrom by crystallization.

PAPERS

IN

POLITE ARTS.

No. I.

ETCHING GROUND FOR ENGRAVERS.

The THANKS *of the Society were this session voted to Mr.* EDMUND TURRELL, *of Clarendon-square, Somerstown, for the following communication on the mode of preparing Etching Ground for Engravers.*

THERE are few articles of more importance to copper-plate engravers than the compound commonly called etching ground. This observation need not be enforced by any practical illustration, as all engravers have at one time or another had sufficient experience to establish the fact.

As there are many recipes in existence, and several of them almost equally good, it is very difficult to make choice without considerable experience, and even then, however judiciously the materials may be proportioned,

yet failure may take place, from the bad qualities of the ingredients, or an improper method of compounding them.

The first object of this paper will be to describe the several materials in their genuine state, together with their characteristic properties.

Secondly, the best method of compounding them, and also their general proportions; with rules for varying the same as occasion may require.

The most important and indispensable material is asphaltum. I believe there is no substance in nature that can completely supply its place; and, indeed, however good all the other materials may be, if this one is bad nothing can be added to make up for its impurity. Asphaltum, or Jews' pitch, is a solid mineral bitumen, supposed by many naturalists to have originated from fluid petroleum, or mineral tar, inspissated by some natural process of evaporation.

The tar that is obtained in the distillation of bituminous coal, by the common process of preparing coal gas, bears a considerable resemblance to petroleum, and if properly treated, by gentle evaporation, first forms a complete mineral pitch, and, by a continuance of the process of evaporation, it at last attains the consistence of asphaltum. This artificial asphaltum is found to answer nearly all the purposes of the natural production, as an ingredient in the coarse black varnishes, such as are used for coach tops, and a variety of japanned wares, such as coal-scuttles, and most of the common iron articles that are required to be preserved from rust by the application of common and cheap varnish.

The artificial asphaltum has a fracture so nearly re-

sembling the natural, that it is very difficult to distinguish them by mere external inspection; yet, generally speaking, the former is of a deeper black colour than the latter, the best of the natural kind being of a fine deep dark brown colour: it is used frequently as a glazing colour in oil painting, and is likewise said to be the article which constitutes the basis of the cake colour used in water colour painting, and known by the name of Vandyke brown. If a small piece of the artificial asphaltum be laid upon a hot iron, the vapour will be very nearly the same as that produced from a piece of coal placed in a similar situation, and a coaly cinder will remain behind.

The most certain method of detecting the natural from the factitious is by the smell.

The products that arise with the tar, in the distillation of coal, and are more or less combined with it, are sulphur and ammonia; which substances, although very volatile in their pure state, have so strong an attraction for the tar as by no means completely to separate from it during its conversion into the artificial asphaltum; therefore, when we submit this substance to the test of hot iron, the ascending vapour has always a nauseous odour, in which both sulphur and ammonia may be distinguished.

The presence of these substances in the artificial asphaltum made from coals, evidently renders it very unfit for the purpose of making etching ground; because, as dilute nitrous acid is used to corrode the copper plate, in the process of *biting-in*, the well known affinity of the acid for the alkali will cause a decomposition of the etching-ground, and shallow or rough bitings will be the consequence. I shall also add, that etching ground, made of such asphaltum, will sometimes act slightly upon the

copper-plate, if the ground should be left upon it for a considerable length of time, and a stain will be produced upon the surface, productive, in some cases, of much evil in the process of *biting-in*. I trust these observations will be deemed as sufficient reasons why the artificial asphaltum should be rejected in making etching-ground.

When a small piece of genuine Syrian asphaltum is placed upon a hot iron, it will, if it be very good and pure, be nearly all converted into vapour, the smell of which is by many persons considered to be agreeable. The essential oil of turpentine dissolves it completely, and forms a liquid varnish that resists the action of dilute nitrous acid. Hence some engravers use it to cover the etched lines on copper plates that have been sufficiently corroded by the nitrous acid in the process of biting-in. I have frequently observed, that the atmosphere does not act upon the surface of pure asphaltum to decompose it, and perhaps it is on this account that it appears to have been so largely used in the composition employed to cover the mummies of the Egyptians.

The above-mentioned properties that pure asphaltum possesses, of resisting the action of dilute nitrous acid, and also of giving hardness and toughness to etching-ground, render it completely indispensable, and consequently an ingredient of the very first importance.

The second, and scarcely less important substance, is Burgundy pitch. This is obtained from the *pinus abies*, or Norway spruce-fir-tree. After the resinous matter is collected from the tree, which is by incision, it is boiled in water, and strained through a linen cloth, and packed in casks or bladders for exportation. It is chiefly pre-

pared in the neighbourhood of Neufchatel, and comes to this country through Saxony.

The best for making etching-ground is sold in bladders, and when perfectly good is of an opaque yellow, rather darker than straw colour. By age it becomes superficially transparent, and at the same time, probably by the loss of its essential oil, becomes so brittle as to be rubbed down between the fingers. That which is the most recent, and therefore opaque, is the best for the engraver's use, as it effects a more complete solution of the asphaltum.

The third and last article is virgin wax. That which is brought from the East Indies is, in general, the best. Most of the English wax is adulterated with deer's suet, which makes it very unfit for the purpose of making etching-ground, because it destroys the toughness and adhesion of the ground to the copper plate. This adulteration may be very easily detected by its softness and clamminess to the feel, and also in its being less transparent when interposed between the eye and the light. If the surface of fine wax be rubbed with a linen cloth, it will take a considerable polish, or gloss, while that which is adulterated will be comparatively dull. If thin shavings are cut with a sharp clean knife from genuine wax, the edge of the knife will leave a fine polished surface where the shaving is separated; but wherever adulteration with suet has taken place, the polish will be proportionably wanting. As these three ingredients (when pure) are all that are necessary to make good etching-ground, I consider it quite useless to multiply the number. Asphaltum, it has been stated, is indispensable, and therefore must

be had at any price. The other articles may be obtained without difficulty.

General directions for preparing and compounding the ingredients above named.

The asphaltum must be broken into small pieces, and if any pieces of clay or other impure matter are observed, they must be carefully taken out, and then it must be ground very fine in a marble or Wedgwood-ware mortar; and while it is under this process, if any hard stony material is discovered, it must be carefully taken out; it will then be ready to be mixed with the other materials, in the following manner.

Put four ounces of Burgundy pitch into a well glazed pipkin; let it melt gently over a slow fire, and move the pipkin round, so that the whole internal surface may be covered with the melted pitch. Then add four ounces of the ground asphaltum, and let the pipkin remain upon the fire until the two substances are tolerably well mixed, which will soon be effected if the mass be well stirred. Then add four ounces more of the asphaltum, and if the heat be increased, and the mass well stirred, the whole may be incorporated, and will be nearly as fluid as melted pitch.

When the asphaltum appears to be thoroughly melted, it should be kept in that state for at least a quarter of an hour, the heat being a little lowered, but it must be stirred all the while, by which means a large portion of the moisture of the Burgundy pitch will be evaporated; and the essential oil of the pitch well be thoroughly incorporated with the asphaltum, and render the etching-ground

more perfect; for when this is omitted, evaporation takes place from the ground when spread upon the plate, after it has been laid on for a month or more, and sometimes in a shorter time, a circumstance which very often produces considerable difficulty to engravers, because when that takes place, the ground is rendered brittle, and frequently chips or flies from the plate, to the great detriment of the tints or lines ruled upon it. When the asphaltum and Burgundy pitch are thus prepared and incorporated, add six ounces of the best virgin wax, and keep the whole well stirred till it is completely mixed, and let it simmer gently for about ten minutes, when it may be taken from the fire, and suffered to cool until it is of the consistence of turpentine, or very thick treacle, and in that state it may be poured out upon the clean surface of a copper-plate, or well glazed earthen-ware dish, in portions sufficient to make a ball, which may in general weigh about an ounce, and when it is sufficiently cold, it must be rolled up into balls by the hands, and kept perfectly clean for use, provided it is found upon trial to be of the proper consistence, but this cannot be judged of until it has been laid upon the plate for a few hours. If it is too soft the etching point will make the lines of unequal breadth, or, as they are technically called, will be drag-lines, being in some parts very fine, and in others very gouty or thick. If it is too hard, the etching point will cause the lines ruled on the ground to chip, and then the edges will be notched or serrated, which would be very prejudicial to the appearance of fine even tints.

There is also another property that may be wanting where the proportions are not properly adjusted, namely,

that of spreading kindly on the copper-plate. This fault in ground may be easily remedied, by the addition of a proper quantity of Burgundy pitch.

As each of the evil qualities above-named are likely to happen, on account of the different properties of the materials: and as, on that account, *general principles* or directions will be much more acceptable than mere arbitrary recipes, I shall now endeavour to lay down such *general rules*, that when either of the faults before described occur it may be immediately remedied.

In the first place, asphaltum makes the ground hard and tough, therefore if it wants that quality, more asphaltum must be added, but it must be previously dissolved in a proper proportion of Burgundy pitch, for otherwise it will be very difficult, if not almost impossible to get it thoroughly incorporated, after the virgin wax has been added. The propriety of this caution will be evident, when it is considered that Burgundy pitch is the *real solvent* for the asphaltum, and must therefore at all times be incorporated with it first; and for this reason it will always be the best way to make the ground rather too hard than too soft, because it is much easier to soften it than to make it harder.

Should the ground, upon trial, be found too hard, a small quantity of virgin wax may be added, which is all that is necessary to answer that purpose.

If, upon trying to lay it upon the copper-plate, it does not spread kindly, but clings to the dabber, and only partially covers the surface of the copper, this fault may be remedied by adding a small quantity of Burgundy pitch; but should this property prevail, and the ground also appear upon trial too soft, then Burgundy pitch and asphaltum

must both be added, after they have been thoroughly incorporated together: for the principal circumstance to be attended to in making etching ground, is completely to dissolve the asphaltum; for although all the recipes I have read or heard of, direct the Burgundy pitch to be added *last*, yet I am convinced, from much experience, that as Burgundy pitch is the true solvent for asphaltum, these two ingredients should be first thoroughly mixed, by which means only can the real and beneficial effects of the asphaltum be fully obtained.

From what has been stated above, the following general rules or principles are deduced.

First, that asphaltum gives hardness and toughness to etching ground, and is indispensably necessary, on account of its valuable property of resisting the action of dilute nitrous acid.

Secondly, that Burgundy pitch acts as a perfect solvent for the asphaltum; and, when mixed, acts also as a vehicle to spread the ground over the surface of the copper-plate, a property essentially necessary to prevent foul biting.

Thirdly, that virgin wax assists in softening the ground, and giving it such a consistence, that when lines are cut through it by the etching point, the edges of each line will be extremely clear and free from flaws or chips, which would be destructive of the beauty expected from the etchings of the present improved state of the art of engraving.

I beg leave to observe, in conclusion, that my principal object in this communication is to lay before my brother artists the result of several years experience, gained by careful practice, rather than submit to them novel experiments or arbitrary recipes which fix no useful or general

principles in the mind, without which every attempt to modify or alter the composition, must be attended with uncertainty, and too frequently with disappointment.

No. II.

COLOURED PRINTS IN IMITATION OF DRAWINGS.

The LARGE SILVER MEDAL *and* FIFTEEN GUINEAS *were this session presented to Mr.* WM. SAVAGE, *Cowley-street, Westminster, for his improvements in Block Printing in imitation of Coloured Drawings.*

SIR, 19th January, 1825.

AFTER laying the specimens of imitations of drawings, produced by the common process of letter-press printing, before the Society of Arts, I beg that you will do me the favour to submit to the Committee of Fine Arts, to which they are referred, the following practical observations on the method of printing them, and on the materials employed in the different inks.

Previous to these observations it may, perhaps, be advisable to take a short retrospect of what had been previously done, to show to the committee clearly my views of the grounds on which I presume to come forward as a candidate for a premium; for although there is no specific class in which I can claim, yet I think the second paragraph in the general notice to candidates gives me a well

founded hope that they will have their merits discussed in a fair and candid manner.

The first attempts avowedly to imitate pen and ink drawings, by means of engraving on wood and printing, appear to have been made at the close of the fifteenth century. It is supposed, that at first only two blocks were used; one to give the outline and the shaded parts, and the other the coloured ground, out of which the lights were cut, to imitate their being put in with white; and this effect was produced when printed on white paper. In a very few years the process was carried further; but these early productions were confined to three or four blocks, printed with different gradations of shade of the same colour, which produced the effect of what is termed *chiaro oscuro;* their general colours were dull ochry yellow, or brown; sometimes they used a grey ink; sometimes a reddish colour, dull blue, and purple.

In many instances they did not engrave an outline, but produced their imitation of a drawing by gradations of tints, the termination of the tint becoming the termination of the subject; and the different depths produced the draperies and shaded parts.

In general, the prints of the early engravers, that I have examined, have more the appearance of being coloured in distemper, than of being washed in with water colours; and in large subjects, the ground is usually broken, the surface of the paper not being completely covered, as if they had been printed on dry paper: in other instances, they appear as if they had been printed in water colours on damp paper, which had caused the colours to run slightly into each other.

Whatever merit there might be in the drawing and engraving, the printing was comparatively much inferior to the productions of the press of Faust and Schoeffer: for there was no great difficulty in making the lights fall nearly where they were wanted; and from the boldness of execution, it was not of material consequence to have great nicety of workmanship.

In the fifteenth, sixteenth, and seventeenth centuries, a number of artists of eminence practised this mode of engraving and printing; but in the eighteenth century the art was not much followed, at least there were few, if any, who studied it as a profession; and I only find the name of John Baptist Jackson, with the addition of John Skippe, Esq. who was an amateur.

The first instance of an attempt to engrave on wood and to print by means of the type press, so as to represent a painting in water colours, appears to be by Jackson, who flourished about 1720 to 1754. There is another by Gubitz of Berlin, who I believe is now living, who has produced some specimens, which I have seen, that reflect great credit on him as an engraver and printer.

I would wish to be understood as making a distinction between *chiaro oscuro* and a painting in water-colours; by the latter expression, I mean a representation of some object or objects in their proper or natural colours; so that when I observe there have been only two attempts to produce imitations of paintings in water colours, it must be taken in this sense.

All the prints in colours by Jackson, that I have seen, show a failure; for the oil which he used in the ink has stained not only the paper on which the subject is printed,

but also the adjoining leaves when it has been inserted in a book; and the specimens in existence remain to show, that the use of oil in coloured printing inks not only changes the colours, but also, by its separating from the colouring matter and spreading, disfigures the paper.

In the course of nearly four hundred years, since we have the first account of the origin of printing, it appears from all we can learn, that there have been only two attempts, besides this, to produce imitations of paintings in water colours by means of this process, one of which failed from the style in which the prints were engraved, as well as from the materials used in the ink.

After this transient sketch I shall proceed to the practical part of printing in colours, and describe the process and the materials by which the specimens were produced.

In selecting a drawing to imitate, it will be found desirable that the tints should be laid on flat, with as little blending into each other as possible.

When this is the case, the trouble both of engraving and printing are considerably lessened, and the copy becomes a much closer imitation of the original, than when the attempt is made with a highly finished subject, where the colours are insensibly shadowed into each other; which requires many blocks, and great attention in analysing the drawing, to produce the desired effect.

The first step, in engraving from a drawing of this nature, will be carefully to examine it, for the purpose of ascertaining how many blocks it will require, and what parts of it will come into each. It will then be necessary to determine which part shall come into the first block to be engraved, and this is of consequence, as it will save a

great deal of trouble in the progress of the work; and materially tend to the accuracy, and to the correct imitation of the drawing.

If the subject has an outline, it ought by all means to be engraved first; as it will be an easy and faithful guide for all the other parts. This outline may be traced, and burnished on the block in the usual manner; after it is engraved, an impression must be printed with black ink; and if the subject be small, it may be burnished on another block, when a tint that is meant to be taken, may be easily and correctly washed in on the block, and thus the whole subject will advance progressively, till it be completed.

If the engraving be large, or even as large as those in the specimens laid before the Society, it will be found difficult to burnish impressions from the first on the succeeding blocks; the paper, from its size, expanding so much in the operation as to prevent the united impressions fitting each other with precision when they come to be printed; to remedy this inconvenience, I adopted a plan, which I believe to be new, and which the engravers on wood acknowledge to be the most accurate method of transferring an impression of one block to another: it is, to make ready in the usual way the first engraved block, so as to produce a good impression in every part; when this is effected, to paste a piece of damp paper by the corners to the tympan sheet, and pull an impression of a full colour; then to take out the block from which the impression was printed, and substitute in its stead a similar block, prepared for engraving on, turning down the tympan, and placing some sheets of paper on it to cause a very heavy pull—then to pull the bar of the press home, and, on

turning up the tympan, there will be found a reimpression on the block, more faithful than any burnishing, or even tracing, and sufficiently distinct for the engraver to touch up all the necessary parts. In small subjects this reimpression will be found very clear and distinct.

If the subject has no outline, I would recommend that the first block engraved should contain all the leading and material parts; for it will be a saving of time, occasionally to engrave on this block a little more than will be wanted to print from it, on account of obtaining the reimpression as a guide for the subsequent ones; and, after the whole subject is engraved and made accurate, to cut away those parts which are not wanted in the colour or shade of this particular block, and this remark will hold good when there is an outline.

I shall now state the coloturing materials that I have used, with a few remarks on their respective qualities, when made into printing inks.

Venetian red makes a smooth ink with little trouble.

Indian red is of a more purplish cast than Venetian red, is difficult to grind smooth, but works well.

Lake is made into ink with facility.

Carmine is a richer colour, and possesses more depth than lake.

Vermilion is a colour that is generally used for red ink; it varies much in its properties and its appearance. To improve its effect, some printers mix with it orange lead, others a little lake, and some few, for particular purposes, a small quantity of carmine; but I have invariably found, in my practice, that adding lake to vermilion destroyed the beauty of both colours, and produced a brick-dust effect. Perhaps the brightest red ink that can be made,

is to take the richest Chinese vermilion, and to add to it a little chromate of lead: but there is one circumstance which contributes much to the beauty of red ink in printing, that is too frequently overlooked or neglected, I mean contrast; and I think I may safely assert, that where a red ink can be introduced so as to come nearly into contact with a good black ink printed of a full colour, it shall look so superior to the same red where it is printed without any other colour on the same paper, as to appear a different composition.

Red lead is inferior to vermilion as a scarlet, but is useful to a certain extent where a duller and paler colour is wanted.

Orange lead is paler and warmer than red lead.

Prussiate of copper is a good brown in oil painting, but I found it very inferior as a printing ink.

Roman ochre is less bright than yellow ochre, but possesses more depth.

Yellow ochre is a good colour in the representation of stone, and is easily ground.

Patent yellow is a colour that possesses little body, and will rarely be found of service.

King's yellow is the colour that was in general use when yellow ink was required, till I introduced chromate of lead, to which it is much inferior, and has also a disagreeable smell.

Chromate of lead is the brightest yellow that I am acquainted with for printing ink, and is particularly easy to grind smooth.

Gamboge may occasionally be used to advantage, but as an ink it does not possess much depth of colour.

Gall-stone and Indian yellow are transparent colours,

and are useful in giving mellow tints where they are wanted.

Burnt terra di sienna is useful where warm yellow or orange is wanted; also for shading yellows, and giving them depth.

Bistre is very difficult to grind smooth.

Burnt umber, in many instances, will be found serviceable as a brown, and in giving shades to other colours in representing the ground, or where dull colours are used. These two last mentioned articles were much used by Jackson.

Sepia is now much used by artists in lieu of Indian ink, as possessing more richness and depth, and is useful where a fine ink is required that is not of an intense black.

Indigo is a powerful deep blue, but not a bright colour.

Prussian blue is a deep colour, and brighter than indigo; they both require a good deal of grinding to make a smooth ink.

Light Prussian blue is nearly equal to Antwerp blue, without its greenish tinge.

Antwerp blue is a bright light blue, with a greenish tinge, and makes a smooth ink with very little trouble.

Verdigris makes an ink of a bright green colour.

Indian ink may be used to give the appearance of a drawing made of the same material, but it does not possess sufficient blackness necessary for the deepest parts; for them good black ink may be used.

Lamp black and ivory black are occasionally necessary; but in general the best black ink will answer the same purpose.

In addition to this list, I am convinced, by experience, that all colours used in painting may be applied to printing

ink where the tone of any particular colour is required; but it will be found in practice that every colour will not produce the same tint when printed that it will when used as a water colour.

Having enumerated the colours necessary for producing imitations of drawings, I shall now give some directions for printing in this style, which are the result of my own experiments; and I wish it to be decidedly understood, that I have not been indebted to any source whatever for any practical information on this subject—the project was entirely my own, and the execution, so far as regards the printing, has been the result of a continued series of experiments, which in many instances were prosecuted for the purpose of overcoming practical difficulties that arose: these difficulties and these experiments frequently elicited new facts, and gave hints for further improvements, which I endeavoured to prosecute.

Jackson published nothing explanatory of the art. The only observations he makes, are—that he had invented a mode of splitting tints; and that he had discarded the common printing press, as not being suitable for this kind of printing, and invented one on a different construction, that was superior in its operations.

Papillon's work, on Engraving on Wood, contains little or no information that can be serviceable at the present day. He advises the use of the rolling press, in preference to the type press; and recommends that each copy should be finished before another is commenced; at the most, he advises not to have more than twenty in progress at the same time, for fear of variations in the paper, from its drying.

An examination of old engravings on wood, printed in

colours was all I had to guide me; for I had not seen Papillon's work till I had arranged the whole of my plan, when most of the drawings were made, and many of them engraved, and did not receive from him one hint in furtherance of my views; for, contrary to both Jackson's opinion and his, I have made use of the common type press, which I have found to answer every purpose; and I think it but justice to state, that the whole of the specimens laid before the Society were printed at a press made by Mr Ruthven, of Edinburgh, which I look upon as a valuable machine.

I have also invariably printed the whole impression from each block before I have proceeded with the continuation, without experiencing any particular variation in the paper, only adopting common precautions to prevent its drying: one of which was, to keep the edges from being too near the fire; and another, to keep the outside wrapper damp.

When wet paper was worked, I found the best method was to interleave it with damp paper, in the same manner that set-off sheets are used in fine work; for when thirteen or fourteen blocks are used, working the paper so many times will make it drier, which alters its dimensions; but when a subject requires only three or four blocks, I should work from five hundred to a thousand impressions, without any other precaution than wetting the outside wrappers at night, and, perhaps, at the dinner hour, without any fear of their getting out of register.

When a subject requires many blocks, or where it is large, four points will be necessary; they keep the paper steadier in its place on the tympan than two, and serve to show any variations that may arise from the shrinking or expansion of the paper.

Sometimes there may occur small parts in a drawing of a different colour from any other part: when this happens it will save a block and the working to introduce these small parts on another block, where they may stand clear of its own tint, and to beat them of their own colour with a small ball.

It would not be practicable to give directions which blocks of a subject should be worked first, and which should succeed each other; for no specific rule would hold good, different subjects requiring the blocks to be worked in different orders. Sometimes, for the purpose of producing the best imitation of a drawing, it will be proper to work the lightest tint first, and proceed gradually to the deepest; at other times, the lightest may come last, and glaze the others; in this case it will, in some measure, take out the indentations, and soften some of the shades into each other, where it is necessary, or advantageous to the general effect.

In commencing a landscape, I should recommend to begin with the sky; as, by avoiding glazing with these light tints, the subjects of the composition will stand more distinct from the back ground than they would otherwise do if these washy tints were printed last. In proceeding to the middle tints, it will be sometimes found advantageous to omit a progressive block, particularly when it covers a large surface, and take the next in order, and perhaps finish with the one that was omitted.

In subjects of natural history, glazing will be frequently found of particular service in softening the tints into each other. This is also the case in fore-grounds of landscapes, and, indeed, wherever sharpness of definition is not required, it will be found advantageous.

In printing washy tints, the ink must be diluted with

varnish to the proper tone, and very little must be used; the block must be carefully and well beat, without any superfluity of ink; if there be any, the tint will not be flat, and the ink will be squeezed into the edges of the engraved part, and give the appearance of lines. The pull must also be very strong, so as to have a great pressure on the surface of the block, otherwise there will be inequality in the colour.

Thus proceeding, the ink must be thickened with colour to match the colour required; and advance progressively to the greatest depths.

In the specimens I sent to the Society, there is an imitation of a pen and ink sketch, with a second block added, to give a tinted coloured ground, with the lights cut out, to represent a sketch on coloured paper with the light put in.

In imitation of slight drawings in sepia, I have sent a specimen with three blocks, and have increased the number in other specimens to eight, for the purpose of showing an attempt to imitate more finished drawings in this manner.

In sculpture, I have sent specimens of a bust and a statue, and also an Etruscan vase: these subjects are from drawings made from some of the finest remains of antiquity in the British museum.

In natural history there is an attempt to represent a flower, an insect, and a quadruped. The flower is not finished so highly as it might have been, but was left in this state, printed on hard-sized paper, purposely to show that, when finished by the hand, the near resemblance this process will produce to drawings, and that water colours may be used on my inks without difficulty.

In the imitation of coloured drawings, I have com-

bined a succession of fourteen blocks; a greater number than ever was used by my predecessors in printing in colours. I had repeatedly been told that the representaton of a washy tint and distances could not be produced by this process;—the sky, the water, and the distances, in the coloured landscape will, I think, refute this opinion.

In venturing before the Society of Arts as a candidate for a premium, I certainly advance no pretensions as an inventor; but rest my expectations on having extended the application of the common printing press; on having introduced additional colouring matters for printing ink; and on having introduced a simple varnish*, in its natural state, for the composition of these inks, that does not affect the colours and renders them perfectly easy in their management, nothing more being required than a stone and mullar. On my part this is a first attempt to open a path to raise printing to a higher scale than was before thought practicable—that of a closer imitation of works of art, and also of nature—which will, I trust, be carried to a far greater state of perfection, and thus enable the press to decorate its own productions with an elegance and splendour well suited to that art which bestows so many blessings on man.

I am, Sir,

&c. &c. &c.

WILLIAM SAVAGE.

A. Aikin, Esq.
Secretary, &c. &c.

* Balsam of Capivi.

PAPERS

IN

MANUFACTURES.

No. I.

BRITISH LEGHORN.

The following REWARDS *were last session given for Bonnets and Hats, made of British materials, platted and knit in imitation of those imported from Leghorn.*

For articles made of indigenous grass, chiefly the crested dogs-tail.

To Sophia Dyer, of West Meon, near Alton, Hants; *two guineas.*

To Anne Dyer, ditto; *two guineas.*

To Mrs. Venn, of Hadleigh, Suffolk; *nine guineas.*

To Anne Venn, ditto; *three guineas.*

To Lucy Hollowell, of Banbury; *five guineas.*

To the children of Mrs. Villebois' school, at Adbury, Berks; *five guineas.*

To Mary Marshall, mistress of Lady H. Bernard's school, at Bandon, near Cork; *two guineas.*

To the children of the school at Bandon; *three guineas.*

For articles made of spring wheat.

To Mr. James Cobbing, of Bury St. Edmunds; *fourteen guineas.*

To Maria Pain, of Boxted, near Bury St. Edmunds; *two guineas.*

To Mrs. Morrice, of Great Brickhill, Berks; *the silver Ceres medal.*

To Mr. James Long, master of the house of industry, at Barham, Suffolk; *the silver Ceres medal.*

To Mrs. Syrett, of Bury St. Edmunds; *ten pounds.*

The specimens produced are mostly superior to those for which rewards were bestowed in the year before: they exhibit considerable dexterity and accuracy, both in the platting and knitting, and some of those which are made of the straw of spring wheat may be mistaken, by ordinary observers, for real Leghorn of average quality. The crested dog's tail, the best probably for this purpose of our indigenous grasses, though of good colour, appears to be deficient in strength and elasticity; but the spring wheat (which is, indeed, the very plant used in Tuscany) appears, under proper management, and in a suitable soil, to produce straw every way fit for the purpose.

No. II.

PLAT OF DOUBLED WHEAT STRAW.

The SILVER CERES MEDAL *was this session given to Mrs.* LOWREY, *of Exeter, for a bonnet made of doubled wheat straw.*

IN common plat, of split straw, the folds are alternately shining and dull, on account of their presenting to view alternately the outside and inside of the straw. In the candidate's plat each single straw is replaced by a double one, consisting of two pieces having the shining or external surface of each placed outside; the consequence of which is a plat with a high degree of lustre, which varies according to its position in respect to the light.

No. III.

CLOTH FROM NEW ZEALAND FLAX.

The SILVER CERES MEDAL *and* FIVE GUINEAS *were this session presented to Mr.* R. JONES, *master of St. George's workhouse, at Little Chelsea, for specimens of twilled Drill and Sheeting, made from New Zealand Flax. The following communication was received from Mr. Jones, and the specimens have been placed in the Society's repository.*

St. George's Workhouse, Little Chelsea,
Feb. 5, 1825.

SIR,

I HAVE herewith sent you a specimen of seven-eighths twilled drill for trowsers, also of nine-eighths sheeting, made by order of Mr. Wilson, from New Zealand flax, obtained by that gentleman from the Colonial Office. As I presume it may show to what use that article may be turned in the manufactures of this country, and as it is now become a subject of public enquiry, I take the liberty of sending the accompanying samples, in order that you may submit the same to the consideration of the Society for the encouragement of Arts, Manufactures, and Commerce, should it be worth their notice.

I am, Sir,

&c. &c. &c.

R. JONES.

A. Aikin, Esq.
Secretary, &c. &c.

P.S. The pieces from which the specimens were taken were spun and woven by pauper children, under my inspection, in this establishment.

The candidate further stated before the committee, that the raw fibre was boiled in alkaline lye, and subjected to the usual bleaching operations for flax or hemp. The cloth was soft to the feel, of a good colour, and seemed likely to prove very durable, furnishing an additional motive to the landholders in the south of England, and especially in Ireland, to make a fair experiment on the culture of New Zealand flax, a plant which produces a greater quantity of fibre than any other vegetable.

PAPERS

IN

MECHANICS.

No. I.

DOUBLE BEVELLED PLANE.

The sum of TEN GUINEAS *was this session given to Mr. C. W.* WILLIAMSON, *New-street, Elizabeth-place, Kennington-cross, for his double bevelled Plane, for smoothing hard or coarse grained woods. The following communication has been received from the candidate on the subject, and a specimen of the Plane has been placed in the Society's repository.*

11, New-street, Elizabeth-place,
Kennington-cross.

SIR,

FEELING sensible that the Society of Arts has ever been liberal in investigating and rewarding those inventions that promote improvement in the arts, which are communicated to the public through its medium, I beg leave to offer my humble effort to its consideration.

It consists of an improved smoothing plane, for the use of cabinet makers, and others who require planes to cut either hard or coarse grained woods, and differs materially from those in common use.

My improvements consist in making the plane-iron of the finest cast-steel, and also in making it with two bevels: that is, bevelling it on both sides, by which means one iron becomes superior in its operation to the double iron that is adopted in the best planes.

To obtain this effect, I have made it sufficiently strong to resist the wedge, and to prevent its breaking by any inequality that might be in the wood or steel. The edge, by means of the two bevels, becomes much stronger, will continue its keenness much longer, and will cut much smoother than any plane with which I am acquainted.

It appears to me that planes had originally but one iron, bevelled on one side; such are yet in use, but are very imperfect tools; that they were materially improved by the addition of a top iron, which, acting as an upper bevel, is the cause of the double-iron plane cutting better than the single-iron plane; but, even then, the working iron, if I might so term the lower iron, has but one bevel, which causes it to be far from a perfect tool to cut hard or coarse wood.

It appears to have been a desideratum for some years to employ cast-steel for plane-irons, on account of the fine and durable edge that it admits, superior to any other steel; for this purpose a plan was adopted of soldering cast-steel to cast-iron; but experience proved to the users of planes that, however good the plan might appear in theory, it did not answer in practice; for it was no uncommon occurrence in using such, for the steel to be forced

from the iron to which it had been soldered; and when this did not occur, yet if the tempering was imperfect it could not be corrected in common practice by any ordinary workman, and I believe they are now nearly out of use. Another plan was to make plane-irons wholly of cast-steel, but these were only with one bevel, and the inequality of the surface, as well as the brittleness of the steel, caused these cast-steel irons to break in a short time, when used for common work, as they could not be made thicker than the welded one, on account of the top iron; thus this plan also failed.

The superiority of two bevels is generally acknowledged in the use of turning tools, of axes, &c. but the principle has never, as far as I know, been adopted in plane-irons prior to my application of it.

Thus it appears that the advantages gained by a cast-steel single-iron, made sufficiently thick to be bevelled on both sides, are a finer and more durable edge than can be obtained by any other steel; little risk of the iron breaking on account of its additional thickness; the plane not choaking; there being no top iron, and therefore no loss of time in fitting it; and its producing a smoother surface than any plane now in use.

I am Sir,

&c. &c. &c.

C. WILKS WILLIAMSON.

A. Aikin, Esq.
Secretary, &c. &c.

Mr. Williamson is in the employ of Messrs. Whiting and Branston; the latter of which gentlemen attended the committee, and stated that he has seen the candidate's

plane in use for smoothing box wood to be engraved upon; that it cuts very smoothly and evenly, more so than other planes; and that the surface formed by it scarcely requires to be finished by the subsequent application of the scraper.

Reference to the Engraving.

Plate I. fig. 3, is a longitudinal vertical section of the plane; *a a* the body, *b* the wedge, *c* the plane-iron. Fig. 4 shows the bevelled part of the iron *c*, and the end of the wedge *b*, full sized.

No. II.

EXPANDING WEDGE.

The SILVER VULCAN MEDAL *was this session presented to Mr.* T. GRIFFITHS, *of the Royal Institution, for his Expanding Wedge for the use of Sawyers. A model of which has been placed in the Society's repository.*

THE wedge is represented in plate II. fig. 5, in which *a* is the handle or centre-piece, and *c c* are two lateral or spring pieces, all made of clean sound ash: they are inserted at one end into the brass or iron cap *b*, and are secured therein by two transverse bolts or pins of thick

iron wire. On the handle *a* is an upright, which carries a cross-piece *d*. The instrument is intended chiefly to save the time and trouble of shifting the common wedges, while sawing up balks of fir into deals. Fig. 6 is another modification of Mr. Griffiths's expanding wedge, in which the spring pieces *c c* are of steel, and the other parts of iron.

The mode of using the instrument, whether the wooden or iron one is employed, is the following. When the saw has made a cut of two or three feet, the loose ends of the springs *c c* are to be brought by hand as near to the centre-piece *a* as their elasticity will admit; the end *b* is then to be introduced into the cut, and the wedge is to be thrust in to the end of the springs, the cross-piece *d* resting on the upper surface of the balk. The elasticity of the springs will be continually opening the cut as the saw proceeds, to the length of about twelve feet; and the wedge, when at its utmost expansion, will be prevented by the cross-piece from falling into the pit. It requires to be adjusted only once for every twelve feet of cut.

No. III.

COPYING SCREWS BY THE LATHE.

The THANKS *of the Society were this session voted to Mr.* CORNELIUS VARLEY, *for communicating to the Society the method adopted by his late uncle, Mr. Samuel Varley, of copying Screws by means of the Lathe.*

52, Upper Thornhaugh-street, Tottenham-court-road, Feb. 16, 1825.

DEAR SIR,

I BEG leave to lay before the Society drawings of the methods which my late uncle, Mr. Samuel Varley, adopted for copying or cutting set screws for ordinary work in the lathe.

I am, Sir,

&c. &c. &c.

CORNELIUS VARLEY.

A. Aikin, Esq.
Secretary, &c. &c.

PLATE V. fig. 1, is a bird's-eye view of a lathe, showing the method of cutting an external thread, by using one of the original true screws *a*, which are cut on one cylinder, and fitted on the maundrel. A piece *b* is made to slide on the connecting bar *c*, for the purpose of adjusting the guide pin *d* to suit the required thread. The screw *e* secures it when adjusted; another sliding bar *ff*

moves at right angles to the bar *e*, having an end screw *g* to fasten it; this carries the screw tool *h*, which of course must correspond with the guide in use; the screw tool is secured to the bar *f* by the clamp plate *i i*; the tool is tightened by the screw *j*, and an additional pinch is given by the screw *k*. *l l* is a rest, which supports the tool while cutting; *m m* a stage or support for the other end of the bar or sliding piece *b*; it has a metal ridge *o o*, in order to support the guide pin *d*: to secure the concentric truth of the screw, there is an adjusting screw *g* underneath the screw-tool *h*, shown in front elevation, fig. 2. The point of this screw bears against the rest, and thus determines the depth of the thread, or diameter of the screw; it also determines the parallelism or taperness of the screw, according as the rest *l* is set parallel or inclined to the axis of the screw. Thus a very complete command of the screw in all its dimensions is obtained.

To use the tool, the left hand holds the end piece *b*, and keeps the guide pin pressed close into the thread of the guide *a*, while the right hand holds the bar *f* as a handle to the turning tool *b*, and secures the cut: in using this tool the lathe is kept always turning in the same direction, and when the cutter *h* touches the shoulder of the screw, both it and the guide-pin *d* are suddenly drawn out of contact by a parallel motion of both hands, and brought forward to begin again at the point of the screw, and this motion is repeated till the screw is finished. There is no occasion to look at the guide point *d*, as the left hand feels when it is in contact.

Fig. 3 shows a screw-tool fixed on the bar *f*, for cutting an internal screw. A piece *r* is screwed on the rest at right angles to it, for the adjusting screw *q* to act against,

it being put the reverse way in the hole, by which the concentric truth and diameter, &c. of the screw are determined as before. In ordinary work there is but little occasion to use this adjusting screw.

Fig. 4, a front elevation of the preceding.

Fig. 5, the bar *f*; the clamp plate *i* being removed to show the two grooves *s* and *t*, which hold the external and internal screw-tools.

Fig. 6, an end view of the sliding piece *b*.

Figs. 7, 8, 9, 10, 11, show the three parts separate of which the sliding piece is composed, besides the two plates *b b*, which are shown in the end view, fig. 6. These plates are rivetted together with the pieces 7 and 10 between, which leaves a space for the bar *c* to slide through. Fig. 9 is a slip for the point of the screw *e* to act against.

Now, although it is frequently requisite in practice to have such a long projecting guide-pin, and for the screw-tool to project so far from the bar *c*, in order to clear large chucks or flanches, yet it is desirable to bring them as near as possible to the bar *c*, when very accurate work is wanted. This is effected in the manner shown in figs. 12, 13, 14.

Figs. 12, 13, the brass end which holds the guide-pin *d*; this pin may be twisted round in the hole to adjust its knife edge to suit the inclination of the threads of the different guides which it has to enter; *u* a pin or finger-piece, by which it is held; *w* the clamp-plate, capable of sliding under the heads of the screws when they are loosened; *x x* different holes along the bar *c*, to receive the clamp screws, by which the cutter may be adjusted to any required distance from the guide-pin *d*.

Fig. 14, an edge view of the clamp-plate *w*, showing the adjusting screw under it.

Figs. 15, 16, show the method of guarding the point of the cutter when making long screws on small cylinders. A small cylinder is very liable to spring away from the tool, which continues following it. It then rises over upon the tool and breaks off its point, while the cylinder is frequently bent, and thereby spoiled. This is effectually prevented by using the shield or guide-plate *y*. I prefer making it of brass, as it soon receives an impression of the thread, and becomes a guide; it prevents the point from entering deeper than it is set for, as the box of a plane does with regard to its iron, and totally prevents all change in the angle of the tool to the work. This point may be used either for deepening the thread of a common screw, in order to make new dies, or for cutting a screw from the screw guides, in which case it is screwed on to the bar *c* with its shield, instead of the screw tool and clamp-plate *w*, fig. 12.

Fig. 17, an edge view of part of the bar *c*.

No. IV.

BARROWING OUT SOIL.

The SILVER VULCAN MEDAL *was this session given to Mr.* DAVID MATHEWS, *Civil Engineer, for an improved mode of Barrowing out Soil; and the following communication has been received from him on the subject.*

Bridlington Quay, Yorkshire,
March, 1825.

SIR,

I BEG leave to hand you, for the consideration of the Society for the Encouragement of Arts, Manufactures, and Commerce, a plan and description of a machine invented and adopted by me in clearing and deepening the harbour of Bridlington, or Burlington, in the county of York, for raising the earth to the top of the piers, which is applicable to the raising of earth and other matter required to be wheeled in barrows to any given spot of a higher level in the making of canals, locks, docks, railroads, &c. &c.

By this invention the very dangerous mode now in use, of a man following the barrow up, and returning before it down an inclined plane, by which many men have lost their lives, and others have been much injured, is avoided. The erection of the stage also is less expensive, and a greater quantity of work can be done in a given time.

Before explaining the invention, it will be necessary to

consider the plan at present in use (see fig. 1, plate VI.) When a barrow is filled, it is wheeled to a stage at the foot of an inclined plane: a rope or chain passing through a pulley, and over a roller at the top of the inclined plane, is brought down to the bottom, and fixed by a pair of slings, usually called barnacles, to the handles of the barrow; the loaded barrow, and a man following it, are then drawn up the inclined plane by a horse, to which the before-mentioned rope or chain leads. The like machinery is fixed at a due distance from this, in such a way, that while the horse proceeding one way draws up the loaded barrow and man following it on one stage, he lets down a light barrow and a man preceding it on the other, and the horse, by retracing his steps, brings a loaded barrow and man up, and lets a light barrow and man down on the alternate stages; so that, as the horse traverses backwards and forwards, the operations are performed alternately at each of the inclined planes. The stages are made about three feet wide, and placed at the angle of about 40° to 50°.

The objections to the plan now invariably practised are, that by the rope breaking, by the horse failing to perform his task, by the inadvertence of the driver, by the man's weight not being sufficient to keep the barrow at a proper angle, by any obstruction to the wheel's running on the inclined plane, by the feet of the man sliding, or by many other causes not necessary here to enumerate, which are very likely and do frequently happen, the man is compelled to relinquish his hold on the handles of the barrow, and is precipitated down the stage, and meets with very serious injury from the fall, if the accident does not prove fatal to him, by the loaded barrow falling upon him.

To remedy these objections, the present plan has been invented, and has been adopted with great success, which I proceed to describe. Plate VI. fig. 2. *a a* a plank, of the usual width, namely, ten or eleven inches, is laid at a small angle, sufficient to keep the barrow-wheel in contact with it; and two strips *b b* are spiked to the edge of this plank, so as to form a trough or groove for the wheel of the barrow to run in. Two pieces of quartering, or small spars, *c c* are fixed on each side, at a proper distance, to guide the handles, by which the barrow is kept in a proper position against the plank upon which the wheel runs. About ten or fifteen feet above the top of the plank and the stage where the loaded barrow is to land, a pulley *d* is fixed to a pole *e e*, through which the rope or chain is passed down to the barrow; to the end of the rope is fastened a hook, which goes into an eye *f* fixed upon the front of the barrow. A pair of slings or barnacles are slid upon the handles of the barrow, previously fastened to the rope at a proper distance, to keep the barrow in a right position to be drawn up the plane or plank, which is when the handles of the barrow are a little below a horizontal line with the wheel of the barrow while running up the plank. The rope, after passing over the pulley *d*, passes through another vertical pulley *g*, at a proper height to suit the draft of the horse. The same operation is performed by the horse traversing backwards and forwards as in the usual plan, viz. a loaded barrow is taken up and an empty one let down, except their being unaccompanied by a man. The pulley *d* is elevated so high as to let the rope from the barrow clear the bank, and yet incline so much inwards, that when the barrow clears the bank it swings in and lands itself, as shown by dotted

lines: the man has only to fix the ropes to the empty barrow, and wheel the full one away.

Upon examination, the committee, I flatter myself, will consider this invention worthy of their sanction, as by the adoption of it many lives may be preserved, and much injury prevented to men who may be employed in this kind of work.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. DAVID MATHEWS.

26, Basinghall-street, London,
March 26, 1825.

SIR,

I BEG leave to inclose the certificate of Sir William Strickland, Bart., of Boynton, chairman to the trustees of Bridlington Harbour, relative to the invention which I have had the honour of communicating to the Society of Arts, &c., through you, and I shall be obliged by your laying it before the committee.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. DAVID MATHEWS.

CERTIFICATE.

SIR, Boynton, March 22, 1825.

I WITH pleasure afford my testimony in favour of the machine of which you claim the invention, and which was

made use of by you in deepening the surface of the harbour of Bridlington, and conveying the soil dug out of it over the surrounding piers. In my opinion, the machine is perfectly effectual to its purpose, simple in its operation, and attended with less expense in conducting the work, and with less hazard to the workmen, than the somewhat similar machines which have heretofore been used for such purposes. I had opportunities of seeing it in use during the whole time that the work was carried on, and till it was entirely finished, and believe no accident took place during the whole time, which could hardly have been expected had the usual machinery been employed, where a man was accustomed, I believe, always, to mount on a plank, along with the wheelbarrow, and descend with the same. This dangerous operation was entirely avoided here, where men so accustomed to mount on the plank were never employed, or looked for, or probably could easily have been met with had they been wanted.

I am, Sir,

&c. &c. &c.

WM. STRICKLAND.

Mr. David Mathews,
Civil Engineer.

No. V.

FOLDING CHAIR.

The SILVER VULCAN MEDAL *was this session presented to Mr. J. P.* HUBBARD, *Leadenhall-street, for a Folding Chair. A specimen of which has been placed in the Society's repository.*

IN camp, on board ship, and in other situations in which stowage room is very limited, demands are continually making on the ingenuity of the cabinet-maker, to compress into as small a space as possible all articles of domestic furniture when not actually in use. The common camp-stool, either with or without a back, thus forms the substitute for a chair; but the webbing does not make a very firm or convenient seat, and this circumstance induced Mr. Hubbard (who is not a cabinet-maker) to add to it a folding wooden seat, with a spring catch. The result is, a light chair of a very firm and simple construction, which may be afforded at a small cost, and when not in use may be hung upon a peg, or may be stowed away in any other manner, occupying not more than one-third of the space required for a chair of common construction.

Plate VII. fig. 13, shows the chair when open or ready for use. It consists, like the camp-stool with a back, of two frames crossing each other, and united by the screw-pins *u u*; *v* is the wooden seat, having two hinges *v v* in

front, and a hole *x* at the back to receive the spring catch *y* in the back rail, as shown fig. 14; beneath the seat are two pieces of webbing *w w* to limit the expansion of the two frames, and thereby to cause the spring catch to fall into its hole without any trouble: fig. 15 is a side view of the chair when folded.

No. VI.

APPARATUS TO ASSIST A WEAK KNEE JOINT.

The LARGE SILVER MEDAL *was this session presented to W.* BROCKEDON, *Esq. Caroline-street, Bedford-square, for a Mechanical Apparatus to assist a weak Knee-joint; a model of which has been placed in the Society's repository.*

A SON of Archdeacon Froude of Modbury, a friend of Mr. Brockedon, had from his childhood been afflicted with lameness, arising from a withered right thigh and leg. The limb is about four inches shorter than the other, and possesses no muscular power, being almost pendulous from the hip joint. He was accustomed to walk with great difficulty, in a bent, almost crouching position, with a stick in the left hand, and the right hand placed over the knee in order to prevent it from giving way by the weight of the body. The father requested Mr. Brockedon to endeavour to contrive some apparatus for the relief of the youth; the request was complied with, and the result was the instru-

ment about to be described, the efficacy of which has been ascertained by a trial of above two years.

A circular steel spring *j j*, figs. 5, 6, 7, plate VIII. goes round the waist, to the right hand side of which is fixed a slender iron bar *l m*, passing along the outside of the limb as low as the ancle; the end turns up a little from beneath the pantaloons, and terminates in a socket or ferrule *s*, capable of receiving the end of a common walking-stick. The iron has a joint *k* parallel to that of the withered thigh, and another joint *n* parallel to the knee joint. To that part of the iron which answers to the thigh is attached a broad semicircular spring *o*, which applies itself to the front of the middle of the withered thigh, making on it the same kind of pressure that the patient was before obliged to make by means of his hand. A sliding piece *p* slips over and secures the joint *n*, as shewn in fig. 5, and is prevented from coming too low down by the step *g*: by means of the stud *r* the piece may be drawn up as far as *o*, in which position the iron will bend at the joint *n*, and thus allow the patient to sit down with ease. When he wishes to walk, he places the end of a stick, held in the right-hand, into the socket *s*, fig. 5, and by the leverage thus obtained causes any degree of pressure that he pleases on the middle of the thigh, by means of the spring *o*. He is thus enabled to walk in a much more upright posture than before, can advance at the rate of two miles or more in an hour, and can persist in this exercise for some hours without intermission.

No. VII.

LITHOTOMY FORCEPS.

The GOLD VULCAN MEDAL *was this session awarded to Mr.* FRANCIS CLULEY, *of Sheffield, surgeons' instrument maker, for his improved Lithotomy Forceps. The following communication was received from him on the subject, and the Forceps has been placed in the Society's repository.*

SIR, Sheffield, March 15, 1825.

I BEG leave to offer to the notice of the Society of Arts a pair of improved lithotomy forceps. To give the Society an idea of the improvement, it will be needful to make a few observations on the application of such instruments. Among the diseases incidental to mankind none are more distressing in their nature than the stone in the bladder, the extraction of which, under the most favourable circumstances, is attended with considerable risk, and much bodily suffering. The latter is frequently much increased by circumstances which can only be discovered during the operation. Such, for instance, as the size, shape, or number of the stones, as well as their consistency in texture. Therefore the result of the operation often depends on contingencies, and on the facility with which the stone can be extracted. Having been a manufacturer of surgeons' instruments for above twenty years, I have had many opportunities of witnessing the operation of litho-

tomy, and am convinced that the kind of forceps in common use are not calculated to extract the stone in that safe and expeditious manner that is desirable; the blades of which, being only slightly concave within, and furnished with teeth, render them extremely objectionable; for the thickness of the blades, added to the diameter of the stone, especially if it is rather a large one, causes such an extension of the forceps that much laceration takes place, and it often compels the operator to apply the knife to enlarge the orifice. The stone also frequently eludes the grasp of the forceps, in consequence of which, when the operator considers he has it fairly within the blades, he applies additional pressure in order to keep hold during the extraction, and thus often defeats his object by the stone breaking in pieces, or by small portions of it breaking off by the action of the teeth, and thus leaving within the bladder such small pieces as may form the nucleus of a second formation of stone. Further, the stone is frequently found in so decomposed a state that it will not bear the least pressure of the forceps.

Having devoted much time and attention to the subject, I have formed an instrument for the purpose, which I consider will obviate the many objections I have stated respecting those now in use. How far I may have succeeded in my endeavours at improvement I must leave to the faculty to determine. The instrument has three blades, and is adapted to extract large and irregular formed stones, also such as may be much decomposed; for when the stone is within the instrument, no pressure is needful to retain it there, and the blades being hollow, and of a bulbous form, receive the stone within their cavity without

the necessity, in ordinary cases, of any extra extension of them during the extraction of the stone.

Many other advantages might be pointed out that would be derived from this instrument, but I consider it would be taking up, unnecessarily, the valuable time of the Society to enter into further detail; I therefore beg leave to submit the invention to the consideration of the Society, and if they should deem it worthy of an honorary remuneration, it will be a source of gratification to me to find that I have in any way contributed to mitigate the sufferings of my fellow-creatures in such distressing cases.

I am, Sir,

&c. &c. &c.

FRAS. CLULEY,

Surgeons' Instrument Maker.

A. Aikin, Esq.
Secretary, &c. &c.

Reference to the Engraving of Mr. F. Cluley's Lithotomy Forceps.

PLATE VIII. Fig. 1 represents the forceps open, and figure 2 sideways, and almost shut; the two opposite blades are jointed in the usual way, only the stud or axis has a projecting head on which the third arm *a b* is jointed at *c*.—*d* and *e* are two small arms secured to the tail *b* by the screw *i*, but moving freely on the screw; they also move freely on the screws *f f* which attach them to the studs *g g*; these studs are tapped, and screw into the sides at *h h*. Now, when the forceps are opened, the small arms *d* and *e* are drawn nearly into a straight

line, (a stop in the joint prevents their opening quite straight, otherwise they would not close again), which pulls down the tail *b* and elevates the head *a*; then, on closing the forceps, the small arms *d* and *e* elevate the tail *b* at the same time that they depress the head *a*. Thus all the three blades open and shut together.

Fig. 3 shows the third blade, with the stud, collet, and screw, which form the joint, separated: fig. 4 shows the inside of the third blade at *c*, and the screws, screw-studs, and small arms, separate.

No. VIII.

INDIAN METHOD OF TWISTING IRON FOR GUN-BARRELS AND SWORD-BLADES.

The THANKS of the Society were this session voted to Capt. T. M. BAGNOLD, and his brother, Capt. M. E. BAGNOLD, of Bombay, for an account of the process employed at Bombay, of making twisted Gun-barrels and Sword-blades, in imitation of those made at Damascus. Specimens of the Gun-barrels have been placed in the Society's repository.

7, High-row, Knightsbridge,
March 7, 1825.

DEAR SIR,

HAVING obtained, through the medium of my brother, Capt. Michael Edward Bagnold, of Bombay, the process used in manufacturing gun-barrels and sword-blades at Damascus, with the peculiar method of tempering weapons

used by the natives of India, I shall be happy to communicate the same to the public through the medium of the Society, if thought worthy of their notice.

I possess several barrels, made in my brother's presence, by a Damascus workman, which, with specimens of the work in different stages, I shall be happy to lay before the committee.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. T. M. BAGNOLD.

The gun-barrels made at Bombay, in imitation of those of Damascus, so much valued by the orientals for the beauty of their twist, are manufactured of iron-hoops, obtained from European casks, mostly British. The more these hoops are corroded by rust, they are proportionably acceptable to the workman; should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated, and drawn out to a bar of about one inch wide, and one-third of an inch thick; it is doubled up in three or more lengths, and again drawn out as before; and this operation is repeated generally to the third or fourth time, according to the degree of fineness required. The bar is then to be heated about one-third of its length at a time,

and being struck on the edge, is flattened out the contrary way to that of the stratification. This part of the operation brings the wire or vein outwards upon the strap. The barrel is then forged in the usual way, but much more jumping is used than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is complete, the twist is raised by laying the barrel from one to five days either in vinegar or a solution of the sulphate of iron, until the twist is raised; this process is called the wire twist. To produce the curl, the bars or straps are drawn out to bars about three-quarters of an inch square, and twisted, some to the right and others to the left; one of each sort are then welded together, doubled up and drawn out as before; and upon the experience of the workman, any intricacy of twist is produced by this drawing out, doubling, and twisting.

Sometimes, to save trouble and economise iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several are laid longitudinally, and welded on. A native artist never works with coal under any consideration; charcoal from light woods forms his only fuel.

In making the sword-blades there are several methods used; some make a pile of alternate layers of soft and hardened steel, with powdered cast-iron, mixed with borax, sprinkled between each layer. These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted, and reforged several times; the twist is brought up in the same way as that in the gun-barrels.

Some swords are forged out of two *broad* plates of steel thus prepared, with a narrow plate of good iron welded between them, leaving a solid steel for the edge of considerable depth.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give strength and toughness.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

The blade was covered with a paste formed of equal parts of barilla, powdered egg-shells, borax, salt, and crude soda, heated to a moderate red heat; and just as the red is changing to a black heat, quench it in spring water.

From the information of this workman, it appears Damascus obtains all its steel from the upper part of the Deccan, where it is called the *fonlode hind*, or Indian steel, of which there are great quantities, but little or no demand for it, the damasque (or *joar*) is natural to this steel, and is raised by immersing it in an acid solution.

No. IX.

PERCUSSION LOCK FOR SHIPS' CANNON.

The GOLD VULCAN MEDAL *was this session presented to* T. DICKINSON, *Esq., Capt. R. N., Purbrook-heath, near Portsmouth, for his mode of applying Percussion Powder to the discharge of Ships' Guns. The following communication has been received from the Candidate on the subject, and a model of the invention has been placed in the Society's repository.*

Naval Club, Albemarle-street,
March 30, 1825.

SIR,

I HEREWITH send you a model of my invention for the application of the percussion principle of ignition to naval ordnance.

The copper tube represents the present touch-hole of the cannon, and that of brass the one to conduct the fire, being a pipe made with a very small orifice, which is to be countersunk to within one inch of the former; which, being pierced by a small drill, continues the percussion communication into the former touch-hole, at one inch from the charge. The covering to that which was the touch-hole, but is now merely a blast-hole, is a protector against wet, and, as will be seen, is removed by the action of cocking, so as to admit of pricking the cartridge.

The great advantages to be gained by this plan are, in substance, instantaneous ignition, security against wet and

wind, and the abolition of the use of the powder-horn, that great source of the very numerous accidents by explosion on board ship, no other priming being necessary than that contained in the cap, a specimen of which I send you.

I am, Sir,

&c. &c. &c.

A. Aikin, Esq.
Secretary, &c. &c.

THOS. DICKINSON, (*b*)
Commander R. N.

Reference to the Engraving of Captain Dickinson's Percussion Lock for Ships' Cannon. Plate II. *figs.* 1, 2, *and* 3.

a The breech of the cannon.

b the nipple on which the cap of percussion powder is placed.

c the hammer.

d, fig. 3, part of the hammer formed into an inclined plane.

e a bolt or pin, lying loose in a horizontal hole, drilled in the cheek of the lock.

f a cover to the vent-hole, the upright part or tail of which abuts against the pin *e*.

g the screw, or centre-pin, on which the vent-cover turns.

h the spring which gives motion to the vent cover during the action of drawing up the hammer (or cocking), after the gun has been fired, so as to cause one end to cover the vent-hole, and the other end to press the pin *e* into the position in which it is shown in the figures.

i the trigger.

k k two transverse holes for the reception of two bolts *l l*, with heads at one end, and screwed at the other end, for the purpose of fastening the lock to the gun, as shown in fig. 2.

m m, fig. 2, screw-nuts to secure the bolts *l l*.

n, fig. 3, the original touch-hole of the gun, serving as a vent-hole, and for the introduction of a pointed wire, to prick the cartridge.

o a metallic tube, with a capillary bore, being a continuation of the nipple, down which the percussion powder acts.

p the cavity or chamber of the gun.

No. X.

VALVE FOR STEAM BOILERS.

The LARGE SILVER MEDAL *and* TEN GUINEAS *were this session presented to Mr. C.* SOCKL, *17, Royal-row, Lambeth, for a safe Valve for Steam Boilers. The following communication was received from the candidate, and a model of the invention has been placed in the Society's repository.*

17, Royal-row, Lambeth,
December 20, 1824.

SIR,

I TAKE the liberty of submitting to the consideration of the Society a safety valve for a steam boiler, which, in my humble opinion, is new, and will afford great security, particularly on board a vessel. Should you find it worth laying before the committee, you will very much oblige

Yours, &c. &c.
CHARLES SOCKL.

A. Aikin, Esq.
Secretary, &c. &c.

P. S. I have got one of my valves fixed upon a small model of a boiler, which is in operation; should it be desired by the committee to see the action of it, I shall be happy to attend.

I propose, that instead of the solid lid which covers the main hole, a copper plate or dish be substituted, as shown in figs. 5, 6, 7, plate I. where *b b* is the copper dish, sur-

rounded by a ring of the same, by which the plate is firmly screwed down upon the rim of the main hole. In the middle of this plate is fixed the valve, of which *f f* is the collar, made of iron or brass; *d* the plug, which is ground air tight into the collar, and is kept in its place by the spiral spring which surrounds its stem, and the stay *c*: over the whole is fixed a strong cross piece *a a*, which is firmly screwed down upon the ring that secures the plate *b*. In the cross piece works a regulating screw *e*, which may be screwed down upon the head of the plug *e*. The operation of the valve is easy to understand. *a* the plate or dish is only one-fourth or one-third the thickness of the other parts of the boiler; it will not afford the same resistance to the steam: when this, therefore, gets beyond the ordinary pressure it will cause the plate to become somewhat convex, and will thus leave a clear space between the collar *f* and the conical plug *d* for the steam to escape; as soon as the power diminishes, the plate will, by its elasticity, return to its former place, and by closing down upon the plug, prevent any further escape of steam.

No. XI.

SECRET LOCK.

The sum of TEN GUINEAS *was this session presented to Mr.* WALTER FRIEND, *Earl-street, Clifton-street, Finsbury, for a Secret Lock; a model of which has been placed in the Society's repository.*

No. 25, Earl-street, Clifton-street,
Finsbury-square.

SIR,

I SUPPOSE almost every lock hitherto made has a key, and if a key be made exactly similar to the proper one, (let the lock be patent or not), it will of course open the lock. The various methods that have been resorted to for procuring false keys, and are still practised every day, are but too well known.

To obviate the frauds and peculation hence arising, I offer the accompanying model of a lock for the approbation of the Society of Arts, the opening and shutting of which is peculiar, and at the same time simple.

Keys or picklocks are of no use in opening it. The key which belongs to it is of no use to any person without the guide, which is so portable as to be put into a pocket-book, &c. and can be varied in such a manner in a few seconds, by such an indefinite number of movements, as to put it out of the power of any person to open it, even if he is in possession of *the guide*, unless he is acquainted with the numbers to which it is set. This renders it safe, strong, compact, and secure. To open the lock you will

observe on *the guide* two circles, with the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, on each, and the stops are now set at 2, 6. Put on the guide to the front of the lock, with the number 1 upward toward the bolt, so that the stops go into the grooves in the plugs; introduce the key, and turn it round, until you can take it out again,—*you will find the lock open.* Now, if you take off the guide, it cannot be shut or locked so as to take out the key; because every time the key comes to be taken out it is open. To shut the lock, put on the guide, and turn the key any part of the way round; then take off the guide,—you will find it shut and secure. You may turn the key as often as you please without any effect.

The advantages which I conceive my lock possesses are

1. That it cannot be picked.
2. That a fac-simile key cannot unlock it.
3. That the true key cannot unlock it without the guide.
4. That even with the true key and the guide in the hands of strangers, the lock is secure, unless the secret of the numbers set to the lock, be known.

I am, Sir,

&c. &c. &c.

WALTER FRIEND, Jun.

A. Aikin, Esq.
Secretary, &c. &c.

Reference to the Engraving of Mr. W. Friend's Lock.

Plate VII. Figs. 1 and 2 are back views of the lock, the plate being removed. A the bolt, it has two arms with studs *b b* projecting forwards, and a point *c*, which form three bearings or supports, all or either of which are

sufficient to keep the bolt out; *d d* a spring, the action of which is to withdraw the bolt, *e e* two similar plates with notches to receive the studs *b b*. *f* a third plate with a notch to receive the point *c*. In fig. 1 the notches of all the three plates coincide with the studs, the obstacles to the action of the spring *d* therefore are withdrawn, and the bolt retracts; fig. 3 shows the front of the lock: when the key is introduced and turned, it moves the plate *f*, fig. 1, and thus, by raising the point *c* out of the notch, it protrudes the bolt, and as the three plates are connected together by three toothed wheels, shown in fig. 4, they all move and keep the bolt protruded, but when the key is turned quite round to withdraw it, the plates again agree with the studs, and the bolt is withdrawn or unlocked; the notch in the middle plate *f* always agrees with the point *c* when the key is withdrawn, therefore to leave it locked, it is requisite to derange the three plates, as shown in fig. 2. This is effected by the peculiar construction of the axis *s*, which carries the plates *e e*: one of them is shown with all the parts separated in fig. 5, *g* the the axis (the bottom face of which is seen in *g*, fig. 3, showing a groove nearly all round it in which is fixed an upright pin *h*, figs. 6 and 7); *i* the toothed wheel which first goes on the axis *g*; *j* a strong spring nut which follows it, and is pinned on so as to hold the wheel very tight, and yet allow it to move alone by applying additional force; over this goes the bar *l l*, figs. 1, 2, and 4, the holes of which are large enough for the nuts *j* to project through; over this is lastly put on the notched plate *e*, which fits on the axis *g*, and is screwed tight against the nut *j* by the screw *m*, which enters the end of the axis *g*. In fig. 2 the screws are removed to show the plates *e e*, and

the end of axis *g*. Now in order to prevent each of these plates from turning without its axis *s*, there are ten holes round the center hole, shown in fig. 8, and a pin *k*, fig. 5, is fixed on one side of the top of the nut *j*, which enters one of these holes and secures it. Fig. 9 shows the middle toothed wheel and notched plate *f*, with the axis *o* separate: they are all screwed together by the side screw: fig. 10 shows the front of the axis, with the notch to receive the projection *n* of the key, fig. 11; *o*, fig. 9, is the end which enters the key. Having described the wheels and their axis, it remains to describe the governor or secret guide plate which, with the key, either arranges or disarranges the plates. Fig 6, the guide plate; fig. 7, a section, with the parts separated; it has an octagonal hole which fits on the octagonal projection round the key hole in fig. 3: on each side and within the circles of numbers are moveable circular plates *r r*, having ten holes round their circumference corresponding to the 10 numbers: *p p* a spring which screws against the edge of the plate by the screws *s s*, but is separated here to show the pins *q q*, each of which, passing through the edge, enters one of the ten holes in the moveable plates *r r*, and secures them from turning round; by which means the stops or guide pins *h h* are fixed at any chosen number, here they are at 6 and 3. Now when this guide plate is put on the face of the lock, as shown by the dotted lines *t t*, fig. 3, the pins *h h* enter the grooves round the face of the axis *g*, and it will be seen that the stops or ends of the grooves correspond with the stopping pins *h*; then, on turning the key any portion round, the middle plate *f* turns and protrudes the bolt, while the two side plates *e e* are prevented from turning by the pins *h h* in the grooves

g g, their respective toothed wheels only turning: then, on removing the plate and continuing to turn the key, they will all three move and appear as in fig. 2, all supporting the bolt, as they disagree: by continuing to turn the key, the bolt can never be withdrawn, though when the key is taken out, the side plates only support the bolt. Then to unlock it, put the guide plate on again and turn the key, all the three notched plates will now move till the end of the grooves *g g*, fig. 3, come in contact with the stopping pins *h h* which detain the side plates *e e* in their right places as fig. 1; and continuing to turn the key till it will come out, the middle plate also agrees, and the bolt is thrown down by the spring *d*. If it be required to alter the secret, raise up the spring *p*, fig. 6, withdraw the pins *q q*, then turn the plates *r r* till the pins *h h* coincide with the intended numbers, and the pins *q q* will fix them; then put it on the face of the lock, introduce the key, and turn it quite round, and take it out again, the stops will then have detained the axis *g g* at the right places: then open the back of the lock, withdraw the screws *m m*, lift up the notch plates *e e*, which will be found in some such position as in fig. 2 (but the middle plate, when the key is out, is always found as in fig. 1) and place them on again as fig. 1, the ten holes round their centers allow ten changes of position in each, screw them fast, and finally shut up the lock: if either one or both the moveable guide plates *r r* be altered the lock cannot then be opened; they must be returned to the right numbers which you keep secret before it can be opened. In fig. 2 the tail of the bolt is broken away to shew the under parts. Fig. 12 a side view of the bolt.

No. XII.

IMPROVED SHIPS' LAUNCH.

The GOLD VULCAN MEDAL *was this session given to Mr.* JOHN COW, *master boat-builder at the Royal Dock-yard, Woolwich, for his improved mode of adapting a Ship's Launch to taking up and laying down heavy Anchors, as well as landing Artillery. The following documents have been received on the subject; and a model of the Boat, with its Fittings, has been placed in the Society's repository,*

Royal Military Academy,
February 1st, 1825.

DEAR SIR,

I BEG to be permitted to forward to you the enclosed communication from Mr John Cow, master boat-builder in his majesty's dock-yard here, containing a description of a proposition of his for laying out and weighing ships' anchors, and for landing and embarking cannon, with a model illustrative of the same, and various certificates from captains in the royal navy, under whom the practice has been made, and from others. The value of the invention has been acknowledged by both the Navy and Ordnance Boards having ordered its adoption; and for the purposes of the anchor it is equally applicable to merchant ships, in which it could not fail of being attended with great advantages. Under the latter point of view in particular, it appears to claim the attention of the Society

for the encouragement of Arts, &c. who have always shown themselves ready to give publicity to, and to honour with their approbation and reward, every useful invention.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. PETER BARLOW.

Royal Dock-yard, Woolwich,

SIR, February, 1, 1825.

I BEG leave to submit for the consideration of the Society for the encouragement of Arts, &c. a model of a seventy-four-gun ship's launch, showing an improvement which I have suggested for rendering her more useful.

It has long been a complaint, that in the event of a ship's getting on shore, and requiring a bower anchor to be laid out for the purpose of heaving off by, that the launch was not equal to that most desirable, and often vitally important object, particularly when there is any sea: not that the boat is unable to carry the weight of the anchor, but that no means were adopted to bring it to that part of her which is alone capable of sustaining it; therefore a raft made of the spare topmasts, and other spars, or two boats, have generally been resorted to on these occasions. The making a raft causes considerable labour, loss of time, and probable injury to the spars; and much danger always attends carrying an anchor by two boats; also great difficulty, at all events, arises in getting it out by either of those methods.

By the method shown by the model, the anchor is sus-

pended, and nearly the whole weight is brought to the midships, and consequently to the greatest sustaining part of the boat; the windlass is so fitted and secured that it is equal to the heaving up of twenty tons; the strain is divided between the sides and the keel of the boat, (which is the main feature of the improvement); the interior of the boat is unoccupied, so that two bower cables may be coiled into her. With the exception of the two small trunks, and the iron stanchion, not any additional lumber is taken in the boat; and when not wanted for this particular service, she is in precisely the same state as boats at present are; every part is so arranged, that not any difficulty can possibly arise in fixing it, and the boat may be hoisted out, the apparatus fixed, and the anchor slung under the bottom, in less than half an hour.

It does not to any great extent impede the passage of the boat through the water, as was proved by a frigate's launch, with a bower anchor suspended, and two bower cables coiled into her, being towed by two pinnaces, at the rate of one knot, against a flood tide in the Tagus. (*See certificate, No.* 1).

By taking an anchor out in this manner the difficulties are considered to be very much decreased, and the danger entirely obviated.

Also ships parting from their anchors would have the means within themselves of picking them up: at present they are obliged to look for fortuitous aid. Should the anchor be left where it would be inexpedient to take the ship, which was clearly evinced in the case of the Minden seventy-four-gun ship, in the East Indies, in 1819, which ship left her anchor in the Coleroon shoal, where she had struck and got off again; and when the ordinary process

by a purchase with the launch was found to be ineffectual, they employed sixty of the natives of Porto-Novo, who made a raft and weighed it.—(*See Hampshire Telegraph, of the 20th September*, 1819).

All nautical men can well appreciate the advantages of preserving an anchor and cable, independent of its actual value, particularly on foreign voyages.

As all ships' long boats, as well as ships of wars' launches, are by this method capable of laying out or weighing their bower anchors, the suggestion is equally applicable to merchant ships.

I am fully aware, although I was not at the time I suggested this plan, that the principle of carrying an anchor under a boat's bottom is not new, for I understand that a boat was fitted in this dock-yard in 1779, and one in 1804, with a view to such practice; also East India ships' boats were about that period so fitted; but the method of carrying the idea into effect was essentially different from the present, and was found impracticable, as far at least as we may judge from its being discontinued. The method at that time proposed, was to have only one *fixed* trunk, which was in the middle of the boat, close to the side of the keel; the windlass, therefore, could only be supported at the ends, and was unequal to the heaving up of any great weight; the great strain, also, was entirely on the sides of the boat. Now, by a reference to the model, it will be perceived, that there are two *moveable trunks* at a proper distance from the keel, thereby enabling a strong iron stanchion to be placed on the keelson, which stanchion supports the middle of the windlass, and consequently makes it of sufficient strength to weigh any weight the boat is able to sustain; and to this peculiarity I am

bold to presume I may attribute the success which has attended my proposition; for after having undergone a probation of nearly five years, during which time more than forty of his majesty's ships' boats have been so fitted, it is at length ordered by the honourable Navy Board, to be adopted in his majesty's service.

I am informed there are about twenty reports at the Navy Office in favour of it; but those reports being "confidential," I have been unable to procure copies of them.

I beg, however, to transmit a copy of one from Captain Warren, C. B. who did me the honour to send it with his full permission to make what use I please of it; also letters from Captain Rowley, Captain Salmond (late first lieutenant of H. M. ship Sybille), and Simon Cock, esq. secretary to the ship owners society.

I must also beg to be permitted to state, that very serious accidents have arisen, and many valuable lives have been lost in endeavouring to weigh bower anchors with a boat. An account of an accident of the most distressing nature appears on Lloyd's List of the 15th of April last:—"A tremendous gale was experienced at Alvarado, 11th and 12th February; a launch belonging to the United States schooner Shark was sent to assist an English schooner that ran on shore during the gale, and got her off; when the boatswain and sixteen men were left to weigh an anchor; but the boat was upset in the gale, and all, except one man, were drowned."

I must submit, that had the boat been fitted according to the accompanying model, she could not possibly have upset, and most probably this afflicting catastrophe would not have occurred. I am therefore led to hope, that

should the Society consider it worthy their attention, and give it publicity in their annual volume, it may be the means of inducing the owners of merchant ships to adopt it, and it can be done at a trifling expense.

Were the consequences attached to the proposition confined to the preservation of property only, perhaps I ought to apologize for troubling the Society with what may not be considered as an entirely new invention, but as the lives of many valuable men have been lost for want of the precautions here offered, I feel that humanity imperatively calls on me not to omit any opportunity of rendering my assistance to lessen the dangers to which seamen are exposed in the execution of their duty.

I must likewise beg to state, that I have adopted this mode of fitting boats to the purpose of landing and embarking heavy guns on a beach through a surf, with perfect safety to the men and boat. The models of two 32-pounder guns, lashed on slides, (each made of a spare half-anchor stock), and prepared for landing, accompanies the model.

The advantages presumed to be attained by this method are, greater facility at all times, and to enable it to be done when there is so much surf on the beach as would preclude the possibility of the boats approaching near enough to land, or to embark them in the usual way.

It is proposed to carry two guns under the bottom of the boat, one on each side of the keel, to bring the boat to an anchor without the surf, at a prudent distance from the shore, (which distance local circumstance smust determine), so as to prevent the boat striking on the gun; a small line is the only communication necessary with the

shore, by which line the larger hauling ropes are conveyed; the guns are lowered from the boat, and hauled up the beach.

Should the operation be carried on where there is a rise and fall of tide, and the guns should not be immediately wanted, it will be only necessary to take the boat in at high water and drop the gun, *which may be taken up as the tide leaves it*; in either case the boat is instantly fit for any other service, without risk of damage by being kept afloat.

The interior of the boat is left clear for stowing the carriages and other stores.

The embarking the guns is done in the same way, care being taken to have anchors of sufficient power to moor the boat without the surf, so as to counteract the weight of the gun, and the resistance it meets with in being hauled off from the shore.

I solicited and obtained permission from the Honourable Board of Ordnance, to lay the plan before a committee of colonels and field-officers of artillery. The committee suggested that a boat should be fitted under my superintendance, and an experiment be made in the Thames. A boat was fitted, and two 24-pounder iron guns were landed and re-embarked in the presence of the committee, the boat being anchored about twenty fathoms from the shore; the last of the two guns was landed, and drawn completely up the causeway, by forty men, and again hauled off the shore, and hove up to the boat's bottom by twenty-nine men in twelve minutes.

The committee expressed themselves perfectly satisfied, and at their suggestion his Grace the Master-General and

Board have ordered it to become one of the standing exercises of the royal regiment of artillery.

I have not been able to procure from the Honourable Board a copy of the committee's report. On my application, I was informed by a letter from the secretary, "that it was not usual to furnish individuals with copies of reports of that description."

I am also informed, that Sir William Congreve has added his testimony in favour of it to his Grace the Master-General.

It has likewise become one of the drills of the royal marine artillery at Portsmouth.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN COW.

CERTIFICATES.

No. I.

(Copy.)

His Majesty's ship Seringapatam,

GENTLEMEN, Lisbon, July 31, 1821.

IN compliance with the request contained in your letter of the of 28th May, I have to acquaint you, that I have made the undermentioned experiments of the launch fitted on Mr. Cow's plan, viz.

		Ft.	In.
The launch, when light, draws	Forward	1	0
	Aft.....	1	10

Yesterday we unmoored ship, hove short on best bower, and suspended the small bower anchor from the boat's bottom without the smallest difficulty, with a kedge laid out, and two boats at intermediate distances holding up bights of the cable; the anchor was hauled out by the people in the launch, and let go from her bottom: the ship being thus moored as before.

		Ft.	In.
Draught of water with the anchor suspended.....	Forward	1	6
	Aft.....	2	6

This day we put a bower cable into the fore part of the launch, and suspended the spare anchor from the bottom:—

		Ft.	In.
Her draught of water was then.....	Forward	3	0
	Aft.....	2	7

We then put another bower cable in, with the principal part of it aft:

		Ft.	In.
The launch then drew.....	Forward	2	11
	Aft.....	2	10
Upper part of wash streak from water line		1	6
Water within the trunks, from the top		0	1

With this weight two pinnaces towed her at the rate of one knot, against a flood tide.

On the small bower being let go from the launch yesterday, a double buoy rope was left fast to the crown of the anchor, by which, taken up through the trunks, and brought to the windlass, with jiggers to the ends of the

levers, the anchor was weighed, and hove close up under the boat's bottom with great ease.

From these experiments, I trust the board will agree with me as to the great utility of this plan, and the benefit it is likely to prove to the naval service, by affording the means of saving a ship from wreck when no other means could be obtained.

As you will perceive that, with the weight of the anchor and two cables, the water was only one inch from the top of the trunks, I should beg to suggest that leather hoses be nailed on the top of the skid to which the trunks are fixed, of sufficient length to come up just clear of the under part of the windlass, that after the operation of suspending the anchor, a seizing may be clapped on to prevent the water washing over them; and as there is a very great strain on the windlass when heaving the anchor up, I should recommend that broad iron hoops be fitted round the windlass, with holes over those in the windlass where the levers are slipped in.

I am, Gentlemen,

Your obedient servant,

(Signed) SAMUEL WARREN, *Capt.*

The Principal Officers and Commissioners of his Majesty's Navy.

No. II.

SIR, Tendring Hall, Suffolk, Jan. 30, 1825.

YOUR letter would have been sooner answered, but I was absent from home when it arrived. I have great pleasure in saying, that my opinion of your boat is such, that if I should ever again command one of his majesty's ships, I should certainly have the launch fitted according to your plan, which I consider most useful.

I am, Sir,
Yours, &c.

Mr. Cow, Dock-yard, Woolwich. JOSH. R. ROWLEY.

No. III.

SIR, Tony-burn, Fifeshire, Nov. 26, 1821.

As a projector, you will no doubt be anxious to hear how one of yours answers, which I have had an opportunity of seeing tried much to my satisfaction.

It is the way you have fitted boats for weighing and carrying out anchors, as the Sybille's was about fourteen months ago. Whilst I was first lieutenant of her, and riding off Vera Cruz, Gulf of Mexico, we weighed the small bower anchor, after being down three weeks, during which time we had a very heavy gale for two days, which was done with great ease by twelve men, and again laid out by one boat towing the launch: the ground was muddy, and the anchor had good hold.

I am not aware whether Captain Rowley has made any report on it; perhaps he may require more trials; but I conceived it would be some satisfaction to yourself, from

one who wishes his humble opinion could be of use in forwarding your designs for the good of our service.

I remain, yours truly,

P. SALMOND,

Late First Lieutenant of his Majesty's ship Sybille.

Mr. Cow, Master Boat-builder, Woolwich-yard.

No. IV.

Ship Owners' Society, New Broad-street,

SIR, May 12, 1824.

THE committee of this Society having had under consideration your improved method of laying out or weighing bower anchors, have directed me to inform you that they highly approve of the plan, as being at once simple and effective.

I am, Sir,

Your very obedient humble servant,

S. COCK, *Secretary.*

Mr. John Cow, his Majesty's Dock-yard, Woolwich.

Remarks on carrying or weighing an anchor with a ship's launch.

SHOULD it be necessary to lay an anchor out, it is submitted, the method of doing it would be to make the bight

of a strong rope fast to the flukes of the anchor; also, a single rope to the ring, to lower the anchor from the cat-head sufficiently low to prevent the boat striking on it; to reeve the fluke ropes through the trunks, bring them to the windlass, and heave the anchor nearly close to the boat's bottom; when it is thus suspended a luff tackle is brought to the ring-rope, which will bowse the stock up as close as may be necessary.

When it is required to pick an anchor up, it is also submitted that the better way would be to sweep it, with the bight of an halser, and, by sending a jewell down, jam the two parts close to the anchor; then reeve the ends through the trunks, and bring both parts to the windlass.

Should it not be possible to sweep the anchor, the windlass is so well secured that it may be weighed with the single buoy-rope, provided the rope is sufficiently strong.

Remarks on landing and embarking heavy guns through a surf.

It is proposed to place the gun on a slide, which slide (should there not be any provided) may be made of a spare half anchor stock, cut in two parts and bolted together, so as to form a bed sufficiently broad for the gun to lie on; a pair of gun-slings is put on the gun to hoist it out or into the ship; also a strong rope to heave it up under the boat's bottom, so placed that the gun should balance. Guys, to keep the gun steady, are put on, which guys should be marked, so as to indicate when the gun is in a direct fore and aft position. Ropes for hauling the gun ashore should

be secured *under* the muzzle. The gun may also be padded, with mats or swabs, at the breech and muzzle, to prevent the bottom of the boat being injured, should there be much motion. The gun should then be placed on the slide, and secured to it by lashings to the bolts which connect it.

When the first gun is hove up under the bottom of the boat, it becomes necessary to relieve the windlass, in order to heave the second up; three capstan bars (if nothing better is at hand) are to be lashed together and placed across the boat; a stopper is made fast to the rope which the gun is hove up by, which stopper is brought to the capstan bars, and the gun suspended from them.

The second gun is hove up in the same manner, which may remain suspended from the windlass.

The boat should be anchored without the surf, at a distance which local circumstances must determine, and her stern backed towards the beach; a small line is the only communication necessary with the shore, by which line the larger hauling rope is conveyed. The guns, when lowered from the boat, are hauled up the beach by the people on shore.

When the gun is to be *embarked,* the boat must be securely anchored without the surf, and the gun placed and lashed on the slide, the same as for landing; the rope must be brought over the stern, and reeved through a leading block that is lashed to an eye-bolt, and brought to the windlass (so as to bring the strain perpendicular), and hove off into a sufficient depth of water, that the boat may float over it; then the rope which is to heave the gun up is reeved through the trunks, and brought to the windlass; the cable is slacked, so as to bring the centre of the boat

over the gun, and it is hove up to the boat's bottom; care should be taken to have the gun-slings sufficiently long to enable them to be got at when alongside of the ship.

References to the figures, plate IX.

Figures 1 *and* 2.

Views of a 74-gun ship's launch, with a bower anchor suspended under the bottom, and a bower cable coiled into the boat.

a the cable, *b b* the anchor, *c c* buoy-rope, *d d d* rope by which the anchor is hove up when weighing, or suspended when carrying, by the windlass; *e* line of flotation when the boat is light; *f* line of flotation should a bower anchor be suspended over the stern of the boat; *g* line of flotation when the bower anchor is suspended (as shown in fig. 1), a bower cable coiled in the after part of the boat, and twenty men in the boat.

Figures 3 *and* 4.

Elevated view and midship section of the launch, with two thirty-two pounder iron guns suspended from the windlass.

h h h the guns lashed on wood slides; *i i i* ropes by which the guns are hove up to the boat's bottom; *k k* water-tight removable wood trunks, through which the ropes pass to the windlass; *l l* the windlass in two parts, connected by a wrought-iron gudgeon and socket; *m* a strong removable wrought-iron stanchion, which supports the middle of the windlass; *o* line of flotation, when there are two thirty-two pounder guns suspended, their carriages, ammunition, stores, and twenty men in the boat; *p* the rope by which the gun is hauled on shore when landing, and off the shore

when embarking; *q q* guy ropes to steady the gun when under the boat's bottom.

Figures 5 *and* 6.

Plan and profile section.—*l l* windlass; *m* iron stanchion; *n n* iron stays attached to the stanchion, to keep it steady in a fore and aft direction; *k* water-tight trunk.

JOHN COW.

No. XIII.

FORCING PUMP.

The sum of FIVE GUINEAS *was this session presented to Mr.* ELISHA PECHEY, *of Bury St. Edmunds, for his Forcing Pump; a model of which has been placed in the Society's repository.*

THE circumstances to be remarked of Mr. Pechey's pump, are, first, the construction of the pump itself; and, secondly, the mode of uniting the pieces of leaden pipe composing the tube through which the water passes.

Whatever be the depth of the well, a frame of timber is to be laid across it at a height not exceeding ten or fifteen feet above the average surface of the water. A semicircular pump-barrel, similar to that invented by Mr. Aust, and described in vol. 37 of the Society's Transactions, is fixed on this frame, and is connected with the ascending pipe, which is furnished with two valves, opening upwards, one being placed below and the other above the junction of the pipe with the barrel, thus forming a forcing pump. The

piston moves on an axis, placed in the centre of a circle of which the barrel is a part of the circumference, and is worked by means of two opposite horizontal levers, fixed on the axis of the piston.

The pump-handle in its frame is placed at the top of the well, having two eyes, one on each side of the centre on which it moves; two series of iron-rods fasten into these two eyes at their upper extremity, and at their lower into the two horizontal levers above mentioned. The rods in the two series are merely simple bars, hooked at each end, except that the upper one in each series is a screw-bolt, taking into a link, in order to afford an easy method of correcting any casual elongation of the rods. By this arrangement the two series of rods balance each other.

With regard to the junction of the several pieces forming the leaden-pipe through which the water is forced, Mr. Pechey observes that the usual mode of joining them, namely, by solder, cannot be effected without the expense of laying a stage across the well, in order to support the workmen, as well as the pot for melting the solder, &c.; and as this requires to be repeated for each juncture, the time thus consumed adds considerably to the total expense. Mr. Pechey unites the ends of the pipes by means of two square pieces of cast-iron, having a leather washer between, the whole being perfectly secured by four screws; and a single workman, suspended in a light frame, like a scale-board, is capable of applying this apparatus.

Certificates from the magistrates and other persons in the town of Bury, attest that a pump on the above construction has been put up in that town, which raises water from a depth of 90 feet, and has given, and continues to give, entire satisfaction.

Reference to the Engraving of Mr. Elisha Pechey's Pump.

Plate X. Fig. 1, *a a* a plank fixed close on the side of the well top, as shown in fig. 2. On this is raised the pump-post *b b*; *c c* the handle; *d d d d* iron-rods; *e e* swivel screws to tighten them; *f f* holes in the plank *a*, through which the rods pass: *g g* slings at the bottom of the rods, to lay hold of the piston levers *t t*, one is shown separate at fig. 3; *h h* the semi-circular pump-barrel from the centre *i* of which the piston *j j* works (fig. 4 shows the piston separate); *k* the valve box; *l* the descending pipe; *m m* the ascending pipe. The barrel is made in two halves, *n n n n* are the fins or flanches by which they are screwed together; *o o* an iron brace curved to fit the barrel: there is one on each side, and they are bolted together by the screw-bolts *p p*, which pass through them and the flanch *n*; *q* is a third brace; all these are screwed at *s s s*, and thus securely fix the barrel to the plank or staging *r r*, which is placed near the bottom of the well, under the plank *a a* (as fig. 5); *v v* the joints of the pipes; *u u* one of their supports against the sides of the well. Fig. 6 shows the joint separated and in section; the lead is beat out to form the flanches *w w*; *x x* are two cast-iron plates, with recesses to receive the flanches; *y* is a leather collar, with a bit of thin copper pipe passing through it to secure the thoroughfare when screwed together by the screws *z z*. Fig. 7, a bird's-eye view of the pump-barrel; *t t t t* the four arms or levers of the piston *j*, which the slings *g g* (figs. 1 and 3) lay hold of. Figs. 8 and 9 show one-half of the barrel separate; and fig. 10 shows a section of that half. They are made by turning a wooden pattern, so as to form a complete circle, like fig. 13, the section from the

circumference to the centre of which is shown in fig. 10. This is cut in halves, leaving the boss *i* on one, and putting another boss like it to the other half; a piece of flanch *n*, and half a valve box *k*, figs. 8 and 9, are to be added; they are then to be cast in metal, and the castings cleaned out by circular hardened steel scrapers (the one used for finishing being rather larger than the other); the scraper is fixed in a clamp *a a*, figs. 9 and 10, secured to the same centre *i* from which the piston is to work.

The Society, in the year 1819, rewarded Mr. William Aust, of Hoxton, for his invention of a circular pump, and published a description thereof, with the method of making it, in their 37th vol. He casts the whole circle, and then turns the hollow by a tool (there described), so as to secure a clean and true semi-circle; the flanches are also turned flat, so that when cut in halves, the parts meet very truly together. Now, to adopt that method to Mr. Pechey's pump, it will require some such alteration as is shown in fig. 11, where the valve-box *k* is made separate, and screwed between the flanches *c c* and *d d*; *e e* being two of the screws which bind the whole together.

Fig. 12 shows the part forming the valve-box separate; one side is flat to receive the ascending pipe *l*, and suit the inner valve; the flanches *c* and *d*, fig. 11, may be screwed close together, without the box, and the pipe *b* and its valve be fixed to the barrel where the dotted circle *f* is placed.

Fig. 13 shows the form of the pattern, or the work before it is cut in two; *c c c c* the two half flanches shown by dotted lines.

No. XIV.

STAND FOR DRAWING BOARDS OF LARGE AREA.

The THANKS *of the Society were this session given to Mr.* JOSEPH CLEMENT, *of Prospect-place, St. George's-fields, for his stand for Drawing Boards of large area. The following communication has been received from him on the subject.*

19, Prospect-place, St. George's-fields,
January 18, 1825.

SIR,

HAVING constructed a table to facilitate the making of large mechanical and architectural drawings, which possesses some peculiar advantages, I shall be happy to submit it to the Committee of Mechanics.

As it is of considerable size it had better be seen by the committee at my house.

I am, Sir,
&c. &c. &c.
JOSEPH CLEMENT.

A. Aikin, Esq.
Secretary, &c. &c.

PLATE X. Fig. 1 is a perspective view of the back part of the table and stand, viewed oblique. The same letters refer to the same parts in each figure.

A A and B B are the four legs of the frame, which being connected at their upper ends, by means of the joints C C, the lower ends are at liberty to be extended or contracted so as to raise or lower the table at pleasure. The legs A A are connected by the cross rails D D, and the legs B B by the rails E E. The lower ends of the legs A B and A B are connected together by two straps E F, one end of each is fixed to the legs B B; the other ends of the straps are fixed to the rollers G G; the rollers G G are fixed on an axis H, the ends of which are supported and turn in bearings I I affixed to the legs A A; at each end of the rollers G G are fixed ratchet wheels J J, having catches K K acting in them, which prevent the straps from unwinding from the rollers. On the end of the axis is placed a lever or arm L, by turning which the legs A A and B B are easily extended or contracted or retained in any position, by the catches K K; M M is a frame about three feet six inches square, and three inches deep, having a semicircular plate N N fixed to each end of it, and a bar O across the middle. At each end of the bar O is fixed an axis or pivot P P, which passes through the sides of the frame M M, and through the upper ends of the legs A A and B B, and forms the centres of the joints C C; on the ends of the pivots P P are screwed nuts Q Q for tightening the joints; see fig. 4 which is a section, through one of the joints; R R R R are four staples fixed to the inner sides of the legs A A and B B through which the semicircular plates N N are at liberty to slide, and may be fixed by the four set screws S S S S, which screw through the staples and act against the semicircular plates, consequently the frame M M is at liberty to turn on its axis P P either way from a horizontal to nearly a perpendicular position, and may be fixed in any situation, by the set screws S S S S. T T is

another square frame, of the same size as the frame M M, and fixed on the upper side of it, as will be hereafter described, U U and V V are four rails which cross each other at right angles, and their ends are fixed in the sides of the frame T T; one half of the depth of the rails U U and V V are cut away where they cross each other, and also the part between the rails, so that the upper and under sides of the rails are all level with those of the frame T T; W and X are two level plates of iron twelve inches square, W one-eighth and X one-fourth of an inch thick, the plate W is let in level with the upper sides of the rails U U and V V and in the middle of the frame T T; the plate X is let in one-eighth of an inch on the under sides of the rails U U and V V and opposite the plate W. Y Y Y Y are four metal pillars, about two inches and three-quarters long, and one inch square, the ends of which pass through the holes in the corners of the plates W and X, and are clenched on the outer sides of them, which keeps the plates parallel to each other, and also fixes them to the sides of the frame T T; the pillars must be placed so as to coincide with the four corners, which are formed with the rails U U and V V. See fig. 2, which is a view of the upper side of the middle part of the frame T T, having the upper plate W removed so as so show the ends of the pillars Y Y Y Y, the rails U U and V V, and also the sliding bars *a a* and *b b*. Fig. 3 is a side view of the same parts. The breadth of the sliding bars *a a* must fill the space between the rails U U, and the sliding bars *b b* the space between the rails V V; the thickness of the sliding bars *a a* and *b b* must fill the space between the plates W and X, so as to slide past each other; the bars *a a* and *b b* also pass through the holes in the sides of the frame T T, and extend to the edges of the drawing board or table Z; four

clamps *c c c c* are screwed to the upper sides of the outer ends of the sliding bars, having a shoulder *d*, (which is level with the upper side of the frame T T) and also a jaw *f* projecting above the shoulder *d*, equal to half the thickness of the drawing board Z, (see fig. 4). The use of the sliders is to support the edges of the drawing board Z, and to prevent its sliding off the frame when elevated; the sliders may be extended or contracted, to accommodate different sized drawing boards, and may be fixed in any position by the four set screws, *g g* and *h h*, which are screwed through the pillars Y Y Y Y, and act against the sides of the rails U and V, which depresses them against the edges of the sliders and prevents them from being withdrawn by the weight of the drawing-board when elevated. To the under side and in the centre of the plate X is fixed a stud or pivot *i*, which passes through a hole in the middle of the bar O, having a washer *j* and a screwed nut *k* on the end of it, to secure it to the bar O, then the upper frame T T together with its appendages will be at liberty to turn round, and may be fixed in four different positions, (that is when the frame T T is parallel to the frame M M) by the two buttons *l l* which are fixed to the upper ends of the semicircle N N, and act against the sides of the frame T T, which prevent it from turning. The drawing-boards must be made level on both sides, so that paper may be placed on either or both if required, and the board turned over.

Having been engaged in making some large mechanical drawings, their dimensions being seven feet by six, I found it impossible to execute them in the usual way; necessity obliged me to contrive some plan of manœuvring the board so as to get to the middle of it

without getting upon it. I have made a drawing-table upon the plan above described, and I find that I can get to any part of it with perfect ease. The table may be used in a horizontal or an elevated position, nearly to a perpendicular; when in the latter situation I hang the drawing-square over the upper edge of the drawing-table, and draw the lines perpendicular; and when long lines are wanted at right angles to them, I turn the board one-fourth round, and then draw the lines as before, which I find to be more perfect than drawing them in a horizontal position. I can place a much larger drawing-board on the stand than the one described and use it with perfect ease.

No. XV.

INSTRUMENT FOR MEASURING SMALL INTERVALS OF TIME.

The GOLD VULCAN MEDAL *was this session given to Mr.* WILLIAM HARDY, *Wood-street, Coldbath-fields, for his Instrument for ascertaining* 1-600*th part of a second of time. One of the instruments has been placed in the Society's repository.*

No. 5, Wood-street, Coppice-row, Spa-fields,
April 19, 1825.

SIR,

I BEG leave to lay before the Society of Arts, a machine or time keeper, for reading off the three hundredth part of a second of time; it may be used for many purposes

where accurate measurement of time is an object, such as the occultation of the stars, and the velocity of sound. This machine has been used by the officers of artillery at Woolwich for some years, and has been of great service in ascertaining the flight of their projectiles, as Dr. Gregory can testify.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WILLIAM HARDY.

Reference to the Engravings of Mr. William Hardy's Instrument for ascertaining small intervals of time.

Plate XII. fig. 1 is a view of the dial plate and hands.

Fig. 2 is a view of the back plate or frame, &c. without the case or box.

Fig. 3 is a view of the lower edge of fig. 2.

The same letters refer to the same parts of each figure. The wheel-work or movement of this instrument is nearly similar to that of a watch; the circle *a* on the dial plate, fig. 1, is divided into 60 parts; the hand *b* turns round in one hour, consequently each division indicates one minute. The large circle *c* is divided into 300 parts; the long hand *d* turns round in one minute, therefore five divisions are equal to one second, and each short division equal to one-fifth of a second. The arc *e* is divided into sixty, and each of them again subdivided, which will be the 120th part of a vibration of the hand *f*. The outside of the arc *e* is numbered from the right hand side towards the left, and

the inside of it from left to right. The hand vibrates from 0 to 60, and makes one vibration while the hand *d* moves one division on the circle *c*, which is the fifth part of one second, and being multiplied by 120 makes 600; consequently one division on the arc *e* is equal to the 600th part of a second. The dotted circles in fig. 2 give the relative diameters of the wheels and pinions at the pitch lines, and the numbers of teeth in each are marked upon them: *g* is the first or large wheel, which is fixed on the end of the box that contains the main spring, the teeth of which work into the pinion *h*, not having any fuzee or chain, as in other watches; on the axis of the pinion *h* is fixed a wheel *i*, which works into a pinion *j*; on the axis of the pinion *j* is fixed a wheel *k*, which works into a pinion *l*; on the axis of the pinion *l* is fixed a wheel *m*, which works into a pinion *n*, on the axis of which is fixed the escape wheel *o*; *p* is the balance, *q* the cock, or part which supports the upper pivot of the balance.

The parts about to be described are in addition to those of a watch. The other end of the axis of the balance *p* passes through the back and front plates *w* and *r*, (see fig. 3,) and on this axis is fixed another wheel *s*, (which is also shown by dotted circles in fig. 1), similar to the balance *p*, but less in diameter; and on the front end of the axis is fixed the hand *f*, which vibrates along with the balance.

The edge of the wheel *s* is rough, having very minute teeth (made with a milling tool) against which acts a very weak spring *t*, which shews the way that the wheel *s* and also the hand *f* were turning at the instant they were stopped; the end of the spring *t* is seen through a hole *u*, in the front of the dial plate, (see fig. 1) the end of the

spring which is in contact with the edge of the wheel *s* is bent downwards by the motion of the wheel, which indicates that the hand *f* was passing from 0 to 50 when stopped, counting the numbers on the inside of the arc *e*; but should the end of the spring *t* have been bent upwards, as represented by the dotted line, it would have shown that the hand *f* was passing from 0 to 10, counting the numbers on the outside of the arc *e*; therefore it may be easily ascertained in what direction the hand *f* was moving when stopped, by examining the direction of the end of the spring *t*. The balance *p* is stopped by the action of a double spring or gripe *v*, which is fixed to the back-plate *w*, by the screw *x*.

Figs. 4 and 5 are side and edge views of the gripe *v*, which is made of brass and well hammered; the two sides act as springs pressing on each other, the bent ends of which pass above and below the balance *p*, and gripe it so as to stop its motion instantaneously; *y* is an axis which passes through and turns in the back and front plates *w* and *r*, on the upper end of which is fixed an arm *z*. At the end of this arm a piece projects, which is made of a wedge shape, to an angle of about 60 degrees, the point of which enters the end of the slit between the sides of the gripe *v*; on the middle part of the axis, between the plates, is formed another arm or lever A, the motion of which is limited between two pins, 1 and 2, which are fixed in the plate *r*; B is a stud, the neck of which passes through a hole in the side of the case, and is fixed in the end of the lever A; consequently, when the stud B is pressed inwards by the thumb, the wedge at the end of the arm *z* is at the same time pressed between the ends of the gripe *v*, and releases the balance, which will remain in motion till

the thumb is removed, when the spring of the gripe will press back the wedge *z*, and the balance will be instantaneously stopped: on the other end of the axis *y*, between the plate *r* and the dial plate, is fixed a third arm C; in the end of it is fixed the bent spring *t*, the use of which has already been described; it will also be observed, when the stud B is pressed inwards to the stop 1, the end of the spring *t* will be just clear of the edge of the wheel *s*, so as not to retard its motion; but when the thumb is removed, the spring will act against the edge of the wheel, before the gripe stops the balance, which will cause the end of the spring *t* to be bent as before described.

The figs. 6 and 7 are two views of the axis *y*, and its arms *z*, A and C, &c.

This instrument is found to be of great importance in measuring the velocity of sound.

Suppose an observation is to be made on the report of a cannon, the observer must be placed in a situation that he can see the flash of the gun, and at as great a distance as can conveniently be measured; the instrument must then be wound up, in a similar manner to a watch; the time, or the position of the three hands must be marked down, the observer must place his thumb lightly upon the stud B, and wait until he sees the flash of the cannon, then he must press forward the stud B, and keep it in that position till he hears the report; when the thumb must be removed instantaneously, which causes the instrument to stop immediately; the hands will then point out the length of time between seeing the flash, and hearing the report; the distance being then measured, the velocity will be ascertained.

The spring, which by its position shows the direction in

which the index *f* has been traversing, was invented by Mr. Hardy in making the model for the Society. The instruments, therefore, which were constructed before that period are without this very useful addition.

No. XVI.

STRIKING PART OF A QUARTER CLOCK.

The sum of TWENTY GUINEAS *was this session given to Mr. J.* AITKIN, 55, *St. John-street, Smithfield, for his improvements in the Striking Part of a Quarter Clock. A model of the invention has been placed in the Society's repository.*

THE parts of a clock concerned in striking the hours and quarters have generally been very complicated, and, of course, liable to be put out of order. Mr. Aitkin, by a novel and very ingenious adaptation of each piece to different uses, has succeeded in greatly reducing their number, as will appear by the following detailed description.

Plate XIII. is a front view of the plate and motion work of a quarter clock, having the dial-plate removed.

Plate XIV. represents a view of the front and upper edge of the several parts in detail.

The same letters refer to the same parts in both plates.

a a is the front plate, or part of the frame to which the motion work is attached.

The train or wheel work is nearly similar to that of the common quarter clock; the diameters of the wheels and

their pinions are represented by the dotted circles (that is to say, their diameters at the pitch lines), and the number of teeth in each marked upon them.

The three lowest and largest dotted circles A F K represent the diameter of the barrels or cylinders which contain the springs or maintaining power, and each of them gives motion to three respective trains of wheels and pinions; the spring A gives motion to the first or fusee wheel B; the wheel B works into the pinion *b*; the second or centre wheel C works into the pinion *c*; the third wheel D works into the pinion *d*; the fourth or escape wheel E acts on the pallets *e*; and the pallets give motion to the pendulum, which regulates the time.

The spring F gives motion to a second train of wheels and pinions, which actuate the striking part of the quarters; G the first or fusee wheel working into the pinion *g*; the second wheel H is fixed on the axis of the pinion *g*, and works into the pinion *h*; the third wheel I is fixed on the axis of the pinion *h*, and works into the pinion *i*; the fourth wheel J is fixed on the axis of the pinion *i*, and works into the pinion *j*; on the axis of the pinion *j* is placed the fly *e*, which regulates the time of striking the quarters; the second wheel H also works in the barrel wheel P, on the axis of which is fixed a barrel or cylinder *f*; on the surface of the barrel are fixed a number of short pins *k k*, which act against the tails of the hammer *p p* which strike the bell *a*; any number of hammers and bells may be fixed at pleasure, if the clock is intended to chime instead of merely to strike; for which latter only one bell is required.

The spring K gives motion to a third train of wheels and pinions, which actuate the striking part for the hours; the spring K gives motion to the first or fusee wheel L,

which works into a pinion *l*, on the axis of which is fixed the second wheel M, which works into the pinion *m*; on the axis of the pinion *m* is fixed the third wheel N, which works into a pinion *n*; on the axis of the pinion *n* is fixed the fourth wheel O, which works into a pinion *o*; on the axis of which is placed the fly which regulates the time of striking the hours.

On the axis of the centre wheel C, and on the front of the plate *a a*, &c. is fixed a wheel R, which works into a wheel S, of equal numbers of teeth; the wheel S turns on a stud *q*, fixed on the front plate *a a*; on the face of the wheel S are fixed four pins, or studs, *r r'' r'' r'''* the use of which will be hereafter described. There is also on the end of the socket of the wheel S fixed a minute pinion *s* of six teeth, which works into the hour wheel T of seventy-two teeth; the hour wheel turns on the axis of the centre wheel C.

On the face of the hour wheel T is fixed a socket which passes through the dial-plate, and on the square at the end of the socket is fixed the hour hand *t*; on the end of the axis of the centre wheel C, which passes through the socket of the wheel T, is fixed the minute hand *u*; to the face of the wheel R is fixed the quarter snail *v*, the edges of which are formed of five concentric parts, of different radii, *v v' v'' v''' v''''*, the use of which will be hereafter described. On the face of the snail *v* is fixed a pin *w*; consequently, when the snail *v*, &c. are turned round, the pin *w* will act against one of the teeth of the star wheel U, and cause it to turn one-twelfth round, when it will be detained by the action of a bent spring *x*, which acts against the points of two of the teeth.

On the face of the star wheel U is fixed the hour snail

V, the edge of which is formed into steps of twelve concentric parts of different radii, marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; the star wheel and snail turn together on a stud *y* affixed to the front of the plate or frame *a a*; W is another stud, which is also fixed in the plate *a a*, and on which turns an hour rack X; in the tail or lower end of the rack X is fixed a pin, or stud *z*, which tends to drop against the edge of the snail V, by a spring *x*, acting against the inside of one of the arms of the rack. The upper edge of the rack is formed into fourteen triangular notches or teeth, into which drops a catch or detent Y: the catch Y turns on a stud 13, affixed to the plate *a a*; in the back part of the tail of the catch is fixed a stud or pin 14; on the other end of the catch Y, and on the back part, is a projecting piece or detent 15, which passes through an oblong hole 16 in the plate *a a*, and against which butts or rests a stud or pin 17, which is fixed in the rim of the wheel O; that is to say, when the catch Y is in the notch 1′ the notch 1′ being cut deeper than the rest, it admits the catch, together with the detent 15, to drop lower than when in any other of the notches; and when in that situation, the pin 17 will rest against it; but should the catch Y be in any other notch the detent 15 will be raised above the pin 17, and the wheel O will then be at liberty to turn round. On the end of the axis of the wheel N is fixed a gathering pallet 18, which acts against the side of one of the teeth of the rack X, and causes the rack to move forward one tooth every revolution of the wheel N, when it will be detained by the catch Y, which drops into one of the notches before the pallet 18 clears the point of the tooth of the rack: if the catch Y is raised till the detent 15 rests against the upper side of the hole

16, a pin or stud 19, which is fixed in one of the arms of the wheel O will also butt against the detent 15, and prevent the wheel O from turning round; the use of the pin 19 will be described hereafter. Z is the quarter rack, which turns on a stud 20, the stud is affixed to the plate *a a*; 21 is a spring, the upper end of which is also fixed to the plate *a a*; the lower end acts against the inside of one of the arms of the rack Z, and tends to press the rack towards the centre of the clock; on the upper edge of the rack are six triangular notches or teeth, in which acts the end of a catch or detent 22; 23 is a stud affixed to the front plate *a a*, and on which turns the catch 22 (see figs. 1 and 2, plate XIV., which are views of the front and upper side); on the socket, and on the front side of the catch is fixed an arm 24, and in the other end of the arm is a slit in which a trigger 25 is inserted, having a pin passing through them which forms a joint; the motion of the joint is limited, that is, the point a' of the trigger 25 will turn to the dotted position a'', when the shoulder of the joint of the trigger will butt against the end of the slit in the arm 24, which limits its motion: on the upper side of the arm is fixed a spring 26, the end of which acts against the upper edge of the trigger and tends to keep it straight with the arm 24. On the lower end or tail of the rack Z, and on the back part is fixed a stud or pin 27, which drops against the edge of the quarter snail *v*, when the catch 22 is raised above the teeth of the rack Z. 28 is another gathering pallet, fixed on the end of the axis of the wheel I, and which acts in the teeth of the rack Z, and causes it to move forward one tooth each revolution of the wheel I, and is detained by the catch 22, which drops into a notch two teeth a head of the pallet, before the pallet

clears the point of the tooth; it must be observed, that when the pallet has cleared the point of the fourth tooth (as represented in the engraving), the other end or tail 29 of the pallet butts or locks against a pin or detent 30, which is fixed in the front of the rack z, and which prevents the pallet 28 from turning any further; it must also be observed that when the pallet 28 is in the same position, it is acting against the eccentric side of a lever 31, which assists in elevating the catch 22 at a certain period; the lever 31 turns on a stud or centre 32 (which is behind the catch 22, and is fixed in the plate *a a*); near the upper edge, and on the front side of the lever 31, is fixed a stud 33, which projects forward beneath the lower edge of the catch 22, therefore, as the pallet 28 turns round, it will elevate the end of the lever, together with the stud 33, which will also raise the catch 22; but this will only take place the first revolution of the pallet 28, after the detent 30 has been removed; for the instant the point of the pallet 28 clears the end or point of the lever 31, that part of the lever drops below the orbit of the pallet, and the side 34 of the lever butts against a pin 35 (which is fixed in the plate *a a*), and will rest in that position till the pallet 28 has gathered up the three first teeth, and begins to act on the fourth tooth of the rack z; then as the rack advances forward, a pin 36 (which is fixed in and projects on the back part of the rack z) acts against the eccentric or lower edge 37 of the lever 31, and raises its point within the orbit of the pallet 28; consequently, when the pallet has just cleared the point of the fourth tooth of the rack z, it will then be in a position ready to act on the point of the lever 31, as shown in plate XIII.

38 is a tumbler or lever, which turns on a centre 39, and

which is fixed in the plate *a a*; 40, is a spring, one end of which is also affixed to the plate *a a*, and the other acts against the tail 41 of the tumbler, which tends to keep the upper edge of the arm 38 against the stud 14 which is fixed in the back part of the tail of the catch Y, as already described; 42 is another pin or stud which is fixed in and projects on the back part of the rack Z, and acts against the edge of the arm 43 of the tumbler; now suppose the notch *vvv* in the quarter snail were turned opposite the stud 27 in the tail of the quarter rack Z, and the catch 22 raised out of the notch, the spring 21 will cause the end 44 of the rack Z to strike the upper edge 45 of the tail of the catch Y, which will depress it, till the detent 15 in the other end of the catch is raised against the upper end of the hole 16, and when in that situation the stud 14 in the tail of the catch Y, will have slid past the corner of the side 38 of the tumbler; the action of the spring 40 will then cause the side 38 to strike or but against a pin 46 which is fixed in the plate *a a*; and when in that situation the stud 14 will be resting against the end of the arm 47 of the tumbler, which will prevent the catch Y from dropping into the rack X, till such time as the pallet 28 has gathered up three of the first teeth of the quarter rack Z, and when in the act of moving the fourth, the stud 42 in the rack Z will be drawn up against the edge of the arm 43 of the tumbler, and when the pallet is just clearing the point of the fourth tooth, the stud 42 will have pulled round the arm 43 of the tumbler together with the spring 40, till the end of the arm 47 has slid past the stud 14; then the catch Y will by its gravity drop into the rack X, and the stud 14 will slip past the corner and along the side 38 of the arm of the tumbler to the situation as represented in plate XIII.

Eight pins or studs 48, are fixed in the rim of the wheel M, which act against the under-side of the tail of the hammer 49; therefore, as the wheel turns round, the stud keeps raising the tail of the hammer till it passes beneath it; then the spring 50, which acts against the lower part 50′ of the hammer 51, causes the hammer to strike the hour bell 52, which will be repeated each revolution of the pallet 18; therefore every tooth of the rack X, which the pallet gathers up, will cause the hammer to strike the bell once. It must be farther observed, that when the hour catch Y is in the notch *i*, the stud *z* is raised above the part 1 of the hour snail V, equal to one of the steps of the snail, consequently, when that part of the snail 1 is turned opposite the stud *z*′ (in the tail of the rack X) and the catch Y be raised out of the deep notch 1′, the stud *z*′ will drop against the edge, or part 1 of the snail V, the rack X will be moved one notch forward, the catch Y will drop into the second notch of the rack, the detent 15 will be raised above the pin 17 of the wheel O, which will then be at liberty to turn eight times round, which will cause the wheel N, together with pallet 18, to turn once round, the wheel M will turn one-eighth round, which will cause the hammer to strike one: then the catch Y will drop into the notch 1′, and the wheel O will be locked; or if any other part of the snail V, say 6, be opposite to the stud *z*, then the rack X will drop forward six notches, when the catch Y is raised; or if the part 12 of the snail V be opposite to the stud *z*, then the rack will drop forward twelve notches, consequently the clock will strike twelve.

53 and 54 are two levers, which turn on two studs 55 and 56; the studs are fixed in the plate *a a*; the lower ends of the levers are connected together by a small rod

57, forming a joint at each end with the levers, therefore the two levers must turn at the same time; 58 is a spring, one end of which is fixed to the plate *a a*, and the other acts against the edge of the lever 53, and presses the lower ends of the levers towards the left-hand side of the plate *a a*; 59 and 60 are two studs fixed in the plate *a a*, which limit the motion of the upper end of the lever 54; 61 and 62 are two arms, one of which is affixed to the detent or catch 22 of the quarter rack, and the other to the detent or catch Y of the hour rack, and against the ends of which act the ends of the levers: consequently if one end of a small wire or string be connected to either of the studs 63 or 64, (which are fixed in the ends of the levers), and the other end continued to the outside of the clock, or to any other part of a room where it may be easily got at in the dark, by pulling the string 65, the catches 22 and Y will be raised at the same instant, which will cause the clock to strike, first the quarters and then the hour.

Having fully described the several parts of the striking part of the clock, we shall now proceed to describe their actions on each other at different periods of the hour.

Suppose the clock has just struck twelve, the minute and hour hands will then be together; it will be observed that during the time the minute hand is advancing from one to fifteen, if the string 65 be pulled there will be no quarters to strike, but the hour twelve will be repeated; if we inspect the hour snail V at this period, we shall find the part 12 opposite the stud *z*, and if we examine the quarter snail, we shall find the side or arc *v* sliding against the stud 27, which prevents the stud from dropping, therefore no quarters will be struck; it must be

also observed that when the minute hand has arrived at the tenth minute, the stud r (in the wheel S, which makes equal revolutions with the minute hand), will just begin to act against the trigger 25; when the stud r has arrived at the first dotted position (see fig. 1, plate XIV) The trigger will be bent into its first dotted position a'' and its shoulder will butt against the end of the arm 24, and prevent it from bending any further; therefore when the stud r has arrived at the second dotted position, the minute hand will be at the first quarter or fifteenth minute, the point of the trigger will be raised to the second dotted position a''', together with the arm 24, and the catch 22 to the first dotted position; the catch will then just clear the point of the tooth of the quarter rack Z; the arc v of the quarter snail will then have passed the stud 27 and admit it to drop on the arc v', (which makes an angle equal to one tooth of the rack,) consequently the rack will have moved one tooth forward, together with the detent or stud 30, which will release the gathering pallet 28; therefore as the pallet begins to turn, it raises the end of the lever 31, together with the stud 33, which acts against the under edge of the arm of the catch, and when the pallet just clears the point of the lever; the point of the catch 22, and the arm 24, will be raised up to the second dotted position, and the point a''' of the trigger will be raised above the stud r to the third dotted position; therefore as the point of the trigger just clears the stud r, the spring 26, which is upon the upper edge of the arm 24, presses the point of the trigger 25 inwards, and when the pallet has turned half round, the catch 22 will drop into the fifth notch of the rack, the pallet will then gather up

the fourth tooth, and the catch will drop into the sixth notch, when the tail of the pallet will be locked against the detent or stud 30; it must also be observed, while the pallet, &c. is turning round, the wheel H turns the barrel wheel P one-fifth round, consequently one of the five pins *k k*, &c. which is fixed in the barrel, will act against the tail of the hammer *p* and cause it to strike the bell Q once, which is the first quarter past twelve, but the hour twelve will not be repeated, unless the string 65 be pulled, then it will first strike the quarter, and then the hour twelve. The use of the joint of the trigger 25 will be further observed here, by inspecting fig. 1, plate 2, viz. when the trigger was in the third dotted position, the spring 26 which acts on the upper edge, had pressed the point a'''' of the trigger inwards, consequently as the catch 22 descends the point a'''' of the trigger will clear the stud *r*, and rest in the lowest position a' ready for the next stud r' to act upon. But if there were no joint in the trigger 25, when the catch 22 descends, the point a''' of the trigger would drop again on the stud *r* as represented in the second dotted position, which would prevent the catch 22 from dropping into a notch of the rack z, and would cause the clock to continue striking till the stud *r* had cleared the point of the trigger, which would be more than a minute.

When the minute hand has arrived at the thirtieth minute, the arc v'' will be opposite to the stud 27, which will admit the rack z to drop two notches, consequently two quarters will be struck; and when the minute hand has arrived at the forty-fifth minute, the side or arc v''' of the quarter snail will be opposite to the stud 27, the stud

r'' will raise the trigger 25, the hour rack will then drop forward three notches, which will admit the clock to strike the three quarters.

But when the minute-hand has arrived at the fifty-second minute, the stud w, which is fixed in the front of the quarter snail v, acts against the lower edge of one of the teeth of the star wheel U, and when the minute hand has arrived at the fifty-eighth minute, the stud w will have moved the star wheel U one tooth forward; then the side or arc 1 of the hour snail V will be opposite to the stud z; the notch v''' in the quarter snail will then be opposite the stud 27, and when the minute hand has arrived at the sixtieth minute, the stud r''' will have raised the trigger 25, together with the catch 22, out of the notch Z of the quarter rack; the stud 27 will then drop to the bottom of the notch v''''; the end 44 of the rack will strike the tail of the hour catch Y, and raise the other end of it out of the notch 1′ of the hour rack; the detent 15 will be raised above the stud 17, till it stops against the top of the hole 16, then the wheel O will turn till the pin 19 stops against the detent 15; the stud z will then drop against the arc 1 of the hour snail V; the hour rack X will move forward one tooth; the rack Z will have moved forward four teeth; the clock will then strike the four quarters; but when it is striking the last quarter, the stud 42 draws up the tail of the tumbler; the stud 14 will then pass the corner 38 of the tumbler; the catch Y will drop into the notch 1″; the detent 16 will then be clear of the studs 17 and 19, which are fixed in the wheel O; the pallet 18 will then turn round and gather up one tooth of the hour rack, consequently the hammer 51 will strike the hour bell once, which will be one o'clock.

The rest of the hours will be a repetition of the same movements already described.

Reference to the figures in plate XIV.

Fig. 1 is a front view of the detent or catch 22, &c. shown in four positions, as already described.

Fig. 2 is a view of the upper edge of fig. 1, with the spring 26 removed. The back part of the shoulder of the studs, that is, the part adjoining the screwed end, is screwed against the face of the front part of the frame or plate *a a* both in this and the following figures; therefore, the projection of each part from the face of the plate *a a* will be easily ascertained, and also the thickness of each part.

Fig. 3 is a view of the upper side of spring 26.

Fig. 4 is a view of the upper edge of the lever 31, the front view of which is represented in its place behind the catch in fig. 1.

Fig. 5 is a front view, and

Fig. 6 is a view of the upper side of the quarter rack Z, and the stud 20.

Fig. 7 is a front, and

Fig. 8 a side view of the hour rack X, and the stud W.

Fig. 9 is a front view, and

Fig. 10 a view on the upper edge of the detent or catch Y, and its stud 13.

Fig. 11 is a front view, and

Fig 12 a view of the upper side of the star wheel U, the hour snail V, and the stud *y*.

Fig 13 is a front view, and

Fig. 14 a view of the upper side of the wheel R, the

quarter snail *v*, the hour wheel T, and the front part of the axis of the centre wheel C.

Fig. 15 is a front view, and

Fig. 16 a view of the upper side of the stud wheel S, the hour pinion *s*, and the stud *q*, on which they turn.

No. XVII.

PORTABLE BRIDGE OF SUSPENSION.

The GOLD VULCAN MEDAL *was this session voted to* COLIN SHAKESPEAR, *Esq., postmaster-general, Calcutta, for his Portable Rope Bridge of Suspension. The following communication was received on the subject; and a model of the bridge has been placed in the Society's repository.*

SIR, Kentish-Town, October 13, 1824.

IN consequence of the personal interview I was honoured with by you, I beg leave, by the desire of Mr. Colin Shakespear, of the Bengal Civil Establishment, to present to the Society of Arts, Manufactures, and Commerce, a model of a rustic portable rope bridge of tension and suspension, which has been introduced into use in India with acknowlenged benefit and advantage to the public service.

The description and other papers which accompany the model, Mr. Shakespear trusts will establish this fact, and encourage him to hope that the advances he has made in the construction of the bridge of which this is the model,

and the still larger one, of double the space, that he is constructing, to be thrown over the Caramanssa river, will render the invention not unworthy of the honourable notice of the Society.

I am, Sir,
&c. &c. &c.
CHRIS. BIDEN,
Commander of H. C. ship
Princess Charlotte of Wales.

A. Aikin, Esq.
Secretary, &c. &c.

General Post-office, Fort William,
Calcutta, March, 1823.

THIS model of a rustic bridge of tension and suspension, for foot passengers, light cattle, carriages, &c. is on a scale of two feet to an inch.

The span of the arch between the transom rollers is eighty feet. The four graduating links, on which the road-way of split bamboo is laid, measure 120 feet. The setting up lanyards, which connect the dead-eyes, extend five or six feet each way beyond the rollers, or points of suspension.

The width is five feet; the road way is *only* raised eight feet from the ground, on friction rollers, resting on crutches, independent of the standard piles, a clear wind way being all that is necessary over torrents and streams not navigable.

The lifts radiating from each grade are carried out on the land side, forming equal angles.

They pass over friction sheaves, morticed close together by a cheek on the head of the piles.

The pressure on the uprights is thus equalized, or perpendicular, having no lateral drag.

These lifts are also made to act equally by separate horizontal preventer braces, and thimbles, passing from one grade to another, and keeping all square.

To check vibration, four diagonal guys are projected each way from the centre of the bridge itself, to the banks of the nullah, where posts are fixed, fifty or sixty feet distant from the standards, in a right line with them, having a block at the head, so that the action of these guys becomes parallel with the level of the bridge.

The model was invented in December, 1822, and the bridge itself, on this principle, without any alteration, was completed in March following, on the Esplanade, opposite the general post-office, Calcutta.

The bridge erected on this scheme for the Berrai torrent is double the scale of the model, or 160 feet between the standards (and nine feet wide) which is allowing 15 or 16 feet clear of the banks of the nullah on each side, the nullah being 130 feet.

The strands, in five graduating double links, are nearly 200 feet in length, decreasing in substance towards the centre, where the strain and stress is the least. They are all of tarred coir rope, three, four, and five inches only in circumference. The setting-up lanyards are Europe hemp rope.

The roughest material of wood has been used, not only to show that strength and economy are the chief requisites, but that rough timbers of twenty-five or thirty feet in length and about one foot in diameter at the bottom (which allows of four or five feet under ground) can be got in any part of the country where the bridge may be required. The main

rollers, or points of suspension, are only raised six feet, the banks being high, and the nullah not navigable. In this experiment, when the rope had been sufficiently stretched, a graceful arch was exhibited of 160 feet span, and nine feet wide.

If any trees happen to be found growing near the banks of nullahs, they will, in their natural state, afford the best possible support.

No pier-heads or abutments are necessary, but the banks should be secured by piles, if the soil is loose and crumbling.

The general section of the water-course should determine the width of the catenary arch to be suspended over it. All projecting abutments, which diminish the channel of a torrent, being injudicious.

In proof of the extreme simplicity of the mechanism, the rope work of the bridge forming the catenary arch was twice set up and taken down, both by moon-light and torch-light, in the course of a few hours.

The second time the whole of the standards and rising platforms were removed, and nothing was seen of the bridge in the morning, which at sunset had been viewed complete.

It is the characteristic of this design so to subdivide every strain and weight as to render the component parts easily subordinate to human power, whether in putting the bridge together, or taking it to pieces, removal from place to place, re-erecting, adjustment, or repair.

The contraction and expansion of the strands may occasion a small rise and fall, but the variation of the temperature of the atmosphere will not derange the rope bridge. If the tension should become considerable in wet weather, a

single person can with facility ease off the running lanyards of the setting-up power.

It is not, however, the quality of coir to dilate or constrict in the same degree with Europe hempen rope, than which it is more durable, one fifth lighter, and about half the price. It is also buoyant, which property may eventually prove very advantageous to rope bridges of this kind.

(Signed) COLIN SHAKESPEAR,
Postmaster-General.

Reference to the figures of Mr. Shakespear's Bridge of Suspension, plate XV.

Fig. 1, a bird's-eye view of part of the bridge, the floor being removed to show the ropes; both ends being alike, the other end is not shown.

Fig 2 a side elevation of ditto.

Fig. 3 an end view, showing the ascent to the bridge.

Fig. 4 a sectional elevation from the bridge or river side of the standards *a a*; *b b* two props on the river side; *c c* props on the land side; *d d d d d* piles driven in the ground, on which are hooked dead eyes *e e e e e*; *f f f f f* the upper dead eyes connected by the lanyards *g g g g g*; *h h h h h* the main tension ropes to support the floor; these pass over a strong roller *i i* with grooves to receive the five pairs of ropes; this roller is well supported behind the standards *a a*; the tension ropes *h h* do not pass in one length over the river, but are connected by clamps and

thimbles at the intervals *j j j* (one of these clamps is shown separate fig. 5); these ropes are all separately tightened by their lanyards *g g*, the end of which passes through the block *k*, and round the windlass *l l* for that purpose, (the block *k* is attached to the bar *m m* affixed to the props *b b*), and each lanyard as it is drawn sufficiently tight is taken from the windlass, and made fast to its peg or cleat in the strong bar *n n* under the roller *i*; *o o* two props reaching from the standards *a a* to the two outer piles *d d*. Strong metal rods pass through the clamps at *j j j*, and through the thimbles of the suspension ropes *p p q q* and *r r*; *s s* a swing rope which helps to support the bridge by means of the metal rods *t t t* rising from the cross rods *j j j*, and also forms a bulwark or fence: these four pairs of ropes *p q r s* pass over pulleys on the sides of the standards *a a*, and are made fast to the piles *v v v v*; *u u* a stay from the top of the standard to the farthest pile: though these ropes are placed orderly to show them, yet they should be so placed as to make the angles on each side of the standard equal, in which case there is no bias on the standards, they have then only to bear the weight, the pulleys equalizing the tension on both sides: the rods *t t t* are kept steady by brace ropes *w w*. *x x* fig. 2, the floor of the bridge made of bamboo (part of which is shown separate in fig. 6); they are tied together at their ends, and reach from standards to standards across the river; the rest of the flooring is made of wood resting on frames morticed into the posts or bearers *y y y y y y*; this framing and part of the floor is shown in fig. 7; a net work fence is extended from the piles *z z* on each side of the bridge to similar piles at the other end, and supported by the top of the posts *y* and rods *t*. Figs. 3 and 4 show the cross bracing by which the

standards *a a* are united; the five ropes *h h* forming the bridge are lashed together by small ropes at different places between the clamps, and are farther united by having bamboos lashed across on each side of the clamps, and close to the middle rod on each side of it. As this requires very secure fixing, the guys A A A A being attached to it to secure the bridge from swinging or vibrating; these guys continue to the shore, and are made fast to trees or piles placed in a line with the standards *a a*, and as high as the bridge, that their action may be in its plane. Fig. 8, part of the middle rod.

Calcutta Goverment Gazette, August 7, 1823.

The Post-Master-General's portable Rustic Bridge of Tension and Suspension.

Of this unique structure the public have heard but little since it so suddenly disappeared in toto from our view on the Esplanade in May last. We have therefore had much pleasure in learning that, under the auspices of government, it was shortly after thrown over the Berai nullah, about eighty miles from Calcutta on the great Benares road, and has been in full use ever since the setting in of the rains, to the accommodation of thousands of people, cattle with merchandize, light hackeries, a detachment of native troops, which, in passing, nearly covered the whole surface, the public mails and banghys, travellers in palankeens, &c. &c. who otherwise must have been pulled over this dangerous torrent in fragile floats, often fatal to poor people.

It is the opinion of several officers, engineers, and others, who have passed over the bridge where it now stands, that it is quite equal to the weight of a field-piece with its carriage, &c.

We have been favoured with the perusal of a letter from an experienced officer, from which we are permitted to quote the following very interesting passages:

"I reached the Berai nullah about 11 A. M. 19th July, when the torrent was rushing down with great violence, so as to preclude the possibility of crossing it by boats or rafts of any description. I of course obtained a secure passage across this dangerous stream over the rope bridge.

"The appearance of the bridge is very beautiful, being surrounded with trees and jungle; and I was surprised to find, that notwithstanding so many thousand people and cattle had crossed it, that the centre of the bridge is still higher than the approach at either side, and the treadway appears to form a segment of an ellipse.

"The bridge appears very strong and solid, and there is little motion perceivable when crossing it; it is raised very considerably above the surface of the water, which is a judicious arrangement, as was evident to me; for when standing on the centre of the bridge, looking at the torrent rolling beneath me, a large tree, which appeared to have been torn from its roots, was seen floating down the stream, and rolled very majestically beneath the bridge.

"The bridge appears in every way most perfectly to answer the purpose for which it was intended, and, by being adopted, would be a source of the greatest convenience, safety, and comfort to every traveller whose destination might lead him across the numerous hill torrents on the road to Benares, as well as on many other routes throughout India."

The official report of the 1st inst., which we have seen, from the gentleman in charge of the bridge, says—

"Since my last report regarding the bridge, we have had the Berai nullah full for days together, and much higher than usual; still nothing has happened to injure the bridge. Trees of enormous size, with all their branches, have been brought down by the torrent, which have passed under the bridge without the slightest accident; in a word, expectation must now be fully realized, as we shall not have the nullah higher than it has been; but if we had, I should not in the least be afraid of any accident whatever."

To the foregoing satisfactory encomiums on the practical stability and simplicity of this very ingenious bridge, we have to add, that it was transported to its present position on a few common hackeries, and set up at once with ease and dispatch by the native carpenter who had constructed the wood work, accompanied by a few callaptes, and the model.

It has neither pier head, nor abutment, and the general section of the nullah has been taken. The span of the arch is 160 feet clear, by 9½ wide, which dimensions it is said exceed those of the Kally Ghaut iron chain bridge by 20 feet in length and one in width. The main transom rollers, or points of suspension, which connect with the setting up power, are only raised six feet from the ground.

The four light piles connected with them rise about 20 feet; to these friction sheaves are morticed outside, for the radiating guys springing from each grade of the rope strands, whereby the roadway is kept in equilibrio.

The whole weight in suspension is somewhere about 6,000 lbs.

Calcutta Government Gazette, 7th of August, 1823.
[First Supplement.]

New Suspension Bridge.

It is proposed to erect the new suspension bridge immediately to the eastward of the present one, without interfering in any material degree with the passage across the latter, which need not therefore be removed until the former is completed. The road-ways leading up to the new bridge, will be formed partly with earth taken out of the nullah, and partly with the earth of the present road-ways.

The site of the new bridge, being the same as that of the original pucka bridge, the road-ways on each side and the direction of the bridge will be nearly in a straight line, and the present awkward winding approach, on the southern side, will be avoided.

The distance between the points of suspension of the new proposed bridge, will be one hundred and twenty feet, this admits of a clear water-way ninety feet broad at high water, and eighty-six feet at low water; which appears ample for the passage of boats underneath the bridge. The height of the road-way will be the same as that of the present bridge.

The depth of water under the bridge may be increased without incurring any risk of danger to the foundation of the piers, from three feet, the present depth, to seven feet.

The breadth of the road-way will be increased from nineteen to twenty-two feet, which is one foot broader

than the Allypoor bridge, and which, it is presumed will be found sufficient, more particularly when the additional bridge now in contemplation, at the mouth of the nullah, shall be completed.

The road-way of the new bridge will be planked in the same manner as the Kally Ghaut bridge: over the planking a larger koah, four inches thick, will be laid, or the bridge may be paved with bricks placed edgewise, in the same manner as in some parts of the Barrackpoor road, which appears fully to answer. The road-way of the bridge will thus be, in all respects, the same as any other pucka road. And as a degree of tension will be given to the chains, sufficient to provide against any undulatory motion, there can be no reasonable apprehension, that cattle will be alarmed in crossing over.

It will be observed that the chains which sustain the bridge, fall below the rail-way as they approach the centre.

The object of this arrangement, which is different from that of the Kally Ghaut bridge, is to diminish the height of the supporting piers, and thus render them more capable of withstanding the continued shake of the chains, at the points of suspension. High piers or pillars of brick-masonry, except they are made exceedingly massy, which would inconveniently contract the entrance to the bridge, would be liable to injury from this cause. The supporting piers are twelve feet high from the foot to the upper chain. The chains rest upon iron beds, built into the masonry of the pier. The inner side of the piers is faced with stone, strongly clamped together. The intention of facing the inner side of the piers with stone, is to support more firmly the chains, which are brought close

to the inner side, in order to give as great a width to the approach as possible. Indeed it would be advisable to build the piers entirely of stone. The difference of expense would not exceed 1,500 rupees.

It is proposed to suspend the road-ways from twelve chains, ranged on piers. These chains will pass over the piers as explained above, and their ends will be fixed in a mass of masonry, and buried under the road-way leading to the bridge, in the same manner as those of the Kally Ghaut bridge. The upright suspending rods will fall from the joints of the main chains, and will be attached to the beams in the road-way, nearly in the same way as has been done in the above-mentioned bridge. The railing will be made of iron, and fixed into the road-way, independent of the main-chains or suspending rods, and will therefore secure them from injury from passing carriages.

The weight of the bridge, and utmost load to which it can be subjected, and the description, and quantity of iron that will be necessary to support this weight, will be as follows:

Weight of the chains . .	23,040 lbs.
of the beams . .	31,500
of the planking . .	34,650
of the paving . .	92,358
	181,548

If the bridge were crowded with men,* each man to

* It is found that a given area crowded with men will have a greater weight than the same space occupied by cattle in the proportion of about nine to seven.

weigh on an average ten stone, and to occupy a space of one foot and a half square, then there will be a load on every hundred square feet of 6,222 lbs., and as the roadway contains 2,200 square feet, the weight of the load will be 136,884 lbs., or the whole weight of the bridge between the points of suspension when crowded with men, will be 318,432 lbs. or 142 tons.

It is found by calculation that from the angle at which the chains are suspended, this weight will act with a tension of 274 tons. It has been mentioned above, that the bridge will be suspended from twelve chains of two inch square iron; and experiment shows, that an inch square of common malleable iron will sustain a tension of between 24 and 31 tons* without breaking; taking the smaller of these two quantities, the resisting power of the bridge will be 1152 tons, or more than four times greater than the utmost tension to which it can be subjected,† which is an allowance for strength considerably greater than has been provided for in the Union bridge, built by Captain Brown over the Tweed, and is such as must ensure the stability of the proposed work.

The present season is unfavourable for its commencement, but it is hoped that the new bridge will be opened before the commencement of the next rains.

* Barlow on the strength of materials, page 231 and 235.

† If loaded with elephants, the tension would be 368 tons. Even in this case there would remain a balance of strength of 784 tons.

[Calcutta Government Gazette, August 21, 1823; and Supplement.]

The Post-Master-General's Portable Rustic Rope Bridge of Tension and Suspension.

We are most happy to learn that Mr. Shakespear has been solicited by an opulent and public-spirited native of rank, Rajah Shebe Chunder Roy, to direct the construction of one of his rope-bridges to be thrown over the Caramnasso river, which intersects the great north-west road, about forty or fifty miles on this side of Benares; and that government has cheerfully sanctioned and encouraged this highly creditable and praiseworthy mark of generosity on the part of the rajah, in thus promoting, at his own personal expense, the convenience and comfort of his countrymen. Mr. Shakespear has accordingly been authorized to afford his aid in giving effect to this laudable intention; and the eminent success which has hitherto attended his singularly curious bridge over the Berai torrent, in so remarkable a season as the present, when the whole country is inundated, and multitudes resort to it as their only succour in passing the torrent, affords sanguine hopes of similar success in his present spirited undertaking, though the span will be little short of three hundred feet*.

* There are stone pier-heads built by a Mahratta, which project considerably into the Caramnassa river on both sides, in a line with the military road; these reduce the span to about

The Hindoo, therefore, who saves his sect from pollution by giving a free passage over this dreaded stream cannot fail to be highly applauded, and considered as a public benefactor.

The Caramnassa, or, more correctly, Kerma-nassa, is one of the rivers of India which have rather unaccountably incurred popular odium. The name implies, the destroyer of pious acts, and in a memorial verse, common amongst the natives, the mere contact of its waters is said to counteract all merit previously acquired by attention to the observances of the Hindoo religion. The real motives for pronouncing such a character upon the waters of this stream are utterly unknown, and even the legend professing to explain it is not very familiar to the Pundits. The late Colonel Wilford has introduced it in his first Essay on the Ancient Geography of India; (*Asiatic Researches*, vol. 14). the commencement of a series, which, although believed to be considerably advanced in manuscript, is now, we apprehend, little likely to be given to the public.

The story, as it appears in the account now cited, is this:—

"The waters of this maulee (the same as the Caramnassa) were originally as pure as those of other rivers, until contaminated by an impure admixture which gave to the stream its present character and appellation.

Frisanku, an ancient king of Oude, aspired to elevate

230 feet, besides intermediate piers, all available for the purpose of an iron chain-bridge, which might therefore easily be constructed similar to Captain Brown's Trinity pier-head of suspension at Newhaven, near Edinburgh.

himself by pious austerities, to a seat amongst the gods, and, by the aid of Visvamitra, effected his object. Indra threw him down again, but the friendly sage arrested his fall in the mid-heavens, and the matter was compromised by the king's being left suspended in the air with his head downwards. In this awkward position, the saliva from his mouth falls upon the Vindhya mountains, where the Karma-nasa rises, and mingling with its waters, renders them impure throughout their course.

Whatever may be the cause, however, the popular superstition is not the less earnest, and what is worse, practical. A brahmin who has to cross the river is in terrible alarm lest he should be sprinkled by the water, and in no case will he ford it. During the greater part of the year the Caramnassa is fordable, even at its mouth, but travellers by land are carried across it in the arms of a ferryman. In the rains, it of course requires a more respectable conveyance, and passengers are ferried over in boats. Luckily for the people who dwell upon its banks the river is not impure for them, and they are permitted to use and touch its waters with impunity.

The sources of this river have never yet been laid down. Colonel Wilford states it to rise in that part of the Vindhya hills, called Vindhya Maukkra. It separates the provinces of Behar and Benares, and is but a few miles west of Buxar, running into the Ganges between two villages, Perper and Barra, the latter of considerable extent, with several mosques of modern erection.

Bancoorah Post-office,
July 17, 1823.

SIR,

I HAVE much pleasure in reporting to you, that your rope bridge of tension and suspension was completed on the 3d ultimo, and has been in full use ever since, over the Berai torrent, near Bissempore, being exceedingly serviceable in safely passing over the public mails and bangy-burdars, who were, as you well know, frequently detained by the torrent for many hours together, to the great detriment of the public service, and frequent injury to the mails and bangys.

Your people were industrious; I was indeed agreeably surprised at the facility with which they erected the bridge, although the model was at hand. And I should have made my report sooner, but I was anxious that it should be accompanied by testimonials, within my own observation, of its stability and efficiency, of which a very marked instance occurred about the middle of last month, when a detachment of sepoys marched over it, almost covering the whole surface with soldiers, cattle, and followers, though such a hasty improvident measure was certainly ill-judged.

A number of gentlemen who have journied, pass the bridge in their palankeens, with bangy-burdars, &c. &c., and have expressed their approbation of the utility and convenience thus afforded, added to the safety with which they got over a dangerous torrent, heretofore only to be passed by fragile rafts of sola, bamboos and cadgeree-pots, which, I am sorry to add, occasion many casualties every season, at this nullah. We have, however, had several

considerable and sudden risings of the waters; indeed I hear, that it is nearly at its full, but this is immaterial, we have nothing to dread, not the slightest accident has occurred, although the width is so great. The standards, which are between fifteen and sixteen feet from the banks, are quite firm, and no pier-heads or abutments are necessary; this alone is a very great point.

It seems a received opinion among the officers with whom I have conversed, that a six-pounder field-piece, with its carriage, &c. may be passed with safety; this, indeed, Colonel Aubutey, of the engineers, appeared confident of.

The principal motion, as described by you, is undulating lengthwise, and tends greatly to preserve the bridge, as vibration does not reach the extremities when the cross rollers preserve the rope from friction; and the setting-up rigging, as also the lifts, are easily managed.

The diagonal guys, projected each way from the centre, are very useful in checking lateral motion, whether from wind or any other cause.

There is no drag from the piles; and I see no necessity for any great tension on the strands forming the road-way, on the contrary, especially, too, as the stream cannot touch the ropes, which will always be considerably above the level of the banks; and the torrent not being navigable, a wind-way is all that is necessary.

I am now decidedly of opinion that the tarred coir-rope, so light and buoyant, will last a long time, especially if your plan of removing it after the rains, when the torrent is dry, is carried into effect, and the standards are taken out of the ground. If, however, these latter should be

injured by white ants, which I do not apprehend, new ones can be substituted for the expense of cutting down and carriage.

The setting up lanyards, dead eyes, &c. are preserved by being under the rising platform, which also affords occasional shelter to travellers.

I have from the first, when I saw your model in Calcutta, had a favourable opinion of your excellent invention, and I rejoice in the opportunity of giving my unqualified opinion, from personal observation, of its great utility. The natives are astonished and delighted, and pray that they may be multiplied.

I am, Sir,

&c. &c. &c.

(Signed) G. N. CHEEK,

Deputy Postmaster.

Colin Shakespear, Esq.

Post-Master-General, Calcutta.

Bancoorah Post-office,

August 1, 1823.

SIR,

SINCE my letter of the 17th July, regarding the bridge, we have had the Berai nullah full for days, and much higher than usual, still nothing has happened to injure the bridge. Trees of enormous size, with all their branches, have been brought down by the torrent, which have passed under the bridge without the slightest accident; in a word, expectation must now be fully realized, as we shall not have the nullah higher than it has been; but if we

had, I should not in the least be afraid of any accident whatever.

I am, Sir,
&c. &c. &c.
(Signed) G. N. CHEEK,
Deputy Postmaster.

Colin Shakespear, Esq.
Post-Master-General, Calcutta.

Bancoorah Post-office,
Sept. 1, 1823.

SIR,

CONSIDERING the almost unheard-of inclemency of the past season, and the novelty of your very interesting experiment, it is with infinite satisfaction I am enabled, at the close of the third month, to report, that your rope bridge stands over the Berai torrent, unaltered in appearance, and apparently uninjured by the excessive wet to which it has been exposed; and the unremitting use to which it has been put, like any other bridge, without restriction, except heavy loaded carts.

Of the very singular properties of the tarred coir-rope I must confess that I had but a very imperfect notion, and I beg to congratulate you on having used it in the construction of your bridge in preference to hempen rope.

The spot on which the bridge is erected, you are aware, is near Bissenpore, on the Benares road; and one coss from the bridge, to the eastward, we find the road leading to Midnapore; of consequence, it is a great thoroughfare: and during the late inundation, which spread over the whole country, the bridge has actually been a rallying

point and succour for thousands passing daily, where the use of a ferry was, for lengthened periods, impossible. The progress of the mails must consequently have been checked for several successive days, instead of passing without impediment over a continuous road-way to the great convenience of the public.

From the great number of forest trees torn up by the roots, and precipitated bodily into the torrent, which have passed freely under the rope bridge, the whole width of the nullah, of 130 feet being left clear, it may be doubted whether a bridge of masonry, with diminished arches, on a sandy foundation, would have withstood the tremendous rush of water which has this year filled the torrent even to the overflowing of its high banks; and it is not only the widest, but the most dangerous nullah on the whole route to Benares that I am acquainted with.

I am, Sir,

&c. &c. &c.

(Signed) G. N. CHEEK,

Deputy Postmaster.

Colin Shakespear, Esq.
Post-Master-General, Calcutta.

SIR, Bancoorah, October 16, 1823.

I HAVE the honour to report to you, that up to this date the rope bridge over the Berai torrent stands perfectly secure, and is of the greatest use, the water still continuing to run with great rapidity.

The late destructive inundation, which rose two feet and a half above even the high banks of the Berai nullah,

and ran with great rapidity over the land pins and ties, washed away the earth about them, also the rising land leading to the approach, so as to endanger the security of the pins, though all braced together. But this did not affect the main standards; and no damage fortunately was done, the road-way being at this critical period full three feet above the stream. The whole fabric, I rejoice to say, is now as strong and complete as the day it was put up before the rains set in, and the natives consider it a boon of inestimable value during the flood, which carried all before it, even to their villages and cattle.

I am, Sir,

&c. &c, &c.

(Signed) G. N. CHEEK,

Deputy Postmaster.

Colin Shakespear, Esq.
Postmaster-General, Calcutta.

[Extract from a letter from Major-General Reynell to Mr. Colin Shakespear, Meeruth.]

September 12, 1823.

"THE more I consider the description and accounts of your rope bridge, the more am I convinced of its hereafter becoming (if fairly brought forward) a most important auxiliary in the warfare of India, that can rarely be carried on in any part of Hindostan which is not divided by rivers, or generally intersected with nullahs, and if I may form an idea of the western side of the Sutlej from the country through which I travelled in approaching

the eastern bank; your bridge would be of invaluable advantage in any expedition towards Lahore which the course of events may bring about."

MEMORANDUM.

To adjust the Rope Bridge Model when affected by the temperature of the atmosphere, or any other cause.

If the main strands fall slack and the roadway should consequently dip, or form the *versed curve*, it will easily be set up by the lanyards and dead eyes. The radiating guys or lifts will then keep it in equilibrio, and an arch or ellipse may be formed at pleasure, in any elevation. In this position the bridge not only looks best, but has less vibration, and is in fact capable of bearing a greater weight.

Remember that the whole tension and weight of the grades is on the main tension rollers, or fulcrum, at *the foot* of the bridge.

If the shackles have been injured by wet, they should be cleaned, and the *iron*-work fresh painted.

C. S.

No. XVIII.

CENTERING FOR LARGE STONE ARCHES.

The GOLD VULCAN MEDAL *was this session presented to Mr.* ALFRED AINGER, *of Everett-street, for a design for Centering to large Stone Arches. A model is placed in the Society's repository, and the design is further explained in the following communication.*

SIR, Everett-street, Oct. 15, 1821.

THE construction of a centre for large stone arches has been considered one of the most difficult tasks which the art of carpentry imposes. The merits, both actual and comparative, of those which have been used during the last century, have been frequently discussed, and successive attempts at improvement have alternately been corrected by failure and confirmed by success.

Much novelty is not to be expected in a subject to which science, experiment, and ingenuity have long been specifically directed; a subject involving few principles, small variety of circumstances, and little choice in the materials to be employed. The present design, therefore, advances little pretension to originality, and its peculiarities will be best understood by a comparison with that of the centering employed in Waterloo-bridge, which it most nearly resembles, and to the real or supposed defects of which it owes its existence.

Those defects consist in—

I. The numerous *halvings*, and other sources of weakness, to which the main timbers were subjected by their repeated intersections.

II. The great obliquity of many of the timbers to the direction of the pressures they sustained.

III. The absence of any effectual means of tightening the several parts of the frame, and of closing the abuttals previously to the action of the load.

With respect to the first of these, it will be admitted, that *halving*, or otherwise seriously wounding a main timber, is a great evil; for whether the strength of prisms vary with the squares, or cubes, or biquadrates (as different theories give it) of their homologous sides, an immense loss of strength is incurred, together with a destructive expenditure of labour and material. It is much worse when the halvings are many times repeated, and worst of all when they are on opposite sides of the timber at small intervals, for then the strength of the piece is limited to the lateral cohesion of the wood between the two halvings, and its liability to bend or break is increased in an alarming degree.

In a design for a roof, of whatever span, or to support whatever load, a proposition to halve the principal rafters would be deemed injudicious, and means would be sought to avoid its necessity. To do this can be no less desirable in the case of centering, which is required to sustain so much greater pressures, and to embrace so much wider openings; in which also permanence of form is of so much greater consequence, affecting as it does the pre-

servation of the curve, and the adjustment of the joints of the superstructure.

A reference to the engraving, Plate XVI. fig. 1, will explain the disposition of the timbers, by which it is proposed to avoid the first of the defects before enumerated. The principal timbers *sb sc sg kc kg* and *kh* are nowhere halved, or in any way weakened, except by the small inconsiderable mortises which contain the tenons of the radial pieces *br*, &c. At their only place of intersection *o* they are received against a cast-iron block, which is shown on a larger scale in an outline elevation at fig. 2, No. 1, and in a shaded section at fig. 2, No. 2. This block, as well as the shoes *a i k s*, is adapted to receive the whole sectional area of the timbers at right angles to the direction of pressure; its weight is reduced by apertures, which are not shown in the engraving, and the shoes are tenoned and bolted to the sole pieces *as ik*. The rib pieces *ab bc*, &c., are bolted to oak or elm knees in the usual manner.

With respect to the second object, that of diminishing the obliquity of the timbers to the direction of the pressures they sustain, it is included in the same arrangements which avoided the numerous intersections, and which consists principally in withholding any direct support from the points *d e f*, and in giving to them an indirect support, transmitted from the points *c* and *g*, by means of a system of wrought iron rods formed and applied in a peculiar manner. These rods, in addition to the purpose just mentioned, give a power of tightening and exciting any part of the frame, the absence of which constituted the third real or supposed defect in the centres of Waterloo-bridge, and in all that have been hitherto made.

This defect requires, therefore, to be now more particularly noticed; and, as in the first case, the impropriety of halving main timbers was illustrated by reference to the construction of a large roof, so may the value of the power which it is now, for the first time, proposed to give to large centres, be enforced by a similar allusion. The great object in all timber constructions is to resolve the area of the frame into a judicious series of triangles; but after this has been done, and the timber accurately fitted together to represent those triangles, it will be found, on being loaded, to yield; the triangles will all become smaller, and the frame will break, or suffer a derangement. This is occasioned by the unavoidable imperfections of the material on which, and of the implements with which, the carpenter is obliged to operate. The hardest timber will yield under a considerable pressure, and the most perfect workmanship will not insure contact at all the points of two opposing surfaces. To overcome this yielding, therefore, and to increase the number of touching points previously to the action of the load, is the object of the carpenter in every instance except that of centering. He accomplishes this object generally by causing each triangle to consist of two sides in a state of compression, and one in a state of extension, as in the common roof, and then, by forcing the middle of the extended side towards the intersection of the compressed sides, he subjects the frame to a strain, more or less, nearly similar in nature and intensity to that which it will sustain in practice. In none of the common operations of carpentry is this precaution omitted; trussed girders, partitions, and roofs, are always fixed in their places in a state of great excitement; the absolute necessity of doing

so has never been doubted, and an attempt is now made to extend the benefit of a similar proceeding to the centres for large arches, and even to such of these as are framed with a view to preserving the greatest possible height above the water-way.

With this view, therefore, in conjunction with that of supporting the points *d e f*, the system of iron rods has been applied. At *c* and *g* are placed cast iron saddles (shown in a section and bird's-eye view at fig. 4), from which proceed the rods *c s g k*, attached at each end to bolts resting on the saddles or passing through the shoes *s* and *k*; from the same saddles proceed two other rods *c o g o* meeting on a common bolt in the centre, and continued on to the timber, where they are wedged and keyed, as shown at *y y* in fig. 2, Nos. 1 and 2. Previously, however, to wedging at *y y*, the rods are brought to any required degree of tension by means of wedges *t* driven above the middle bolt *x*, by which it is forced downwards in an aperture formed for that purpose in the cast-iron block. The bolts which receive the upper ends of the rods just described are connected at the saddle by wrought iron loops *v v* (fig. 4). From the middle bolt *x* proceed two other series of smaller rods, terminating at bolts in the shoes *s* and *k*; and from each of the two bolts in the saddles *c* and *g* also proceed two series of small rods meeting at *e*, or ending in bolts fastened to the smaller shoes *a* and *i*. It is hardly necessary to explain, that there is a precisely similar arrangement of rods on the other side of the timber. The smaller rods are received at their intersections *b r q d p e*, &c. on bolts resting in the semi-cylindrical cavities of cast-iron bearing plates, as shown at fig. 5.

Between the timber and each of the cast-iron plates at *l m n p q* and *r*, two pairs of oak wedges, side by side, are introduced, which, together with the iron wedges at *t*, constitute the means of tightening and exciting in any degree, any or every part of the frame. In consequence of using two pairs of wedges, each cast-iron plate becomes susceptible of a universal motion, by which a precisely equal degree of tension may be communicated to all the rods, independently of small differences in their length, or of any common irregularities in the timber or castings.

It remains now to describe the other object of the iron rods; namely, the transmission of part of the support obtained at *c* and *g* to the points *d e* and *f*. Inasmuch as the points *c* and *g* cannot approach without crushing the pieces of the rib *c d d e*, &c. or closing their abuttals (which abuttals, if not close in the first instance, may be secured by the insertion of their wedges), the intersection *o* of the rods *c o g o* cannot descend till some part of the rods *s c c o k g g o* stretches or breaks; and as the force which a given load at *e* will exert towards producing this effect is easily estimated, the rods in question may, without difficulty, be made adequate to the required resistance, and the point *e* may be effectually sustained by the intervention of the vertical piece *e o*. In like manner *d* and *f* will be sustained by the rods *c p p e* and *e n g n* through the intervention of the radial pieces *d p f n* which may be connected together on each side of the braces *c o g o* by cast-iron clips to prevent the necessity of weakening those braces by large mortices. This plan was adopted in the model on which the experiments hereafter to be described were made; though, on account of the smallness of the scale, they are omitted in the engraving.

The wrought-iron rods which I have been describing, discharge a third duty of not less importance in an economical view than those which have been already noticed; they supersede the necessity of any bolts, straps, or ties, used merely as means of connection; and thus the whole quantity of iron in this design, notwithstanding its extensive use as a means of support, would not be more than half of the quantity employed in the centres of Waterloo-bridge, where it fulfilled no other purpose than that of uniting the several parts of the timber frame.

Having said that the support of the points *d e f* is to be derived from *c* and *g*, it may be necessary to allude to the adequacy of these latter to afford that support, in addition to sustaining that portion of the arch stones immediately above them. Their sufficiency in this respect is easily shown by calculation, has been proved by experiment, and may thus be inferred. In the centres of Waterloo-bridge each of the points *d e f* was supported by two braces extending to the extremities *s* and *k*. Those meeting at *e* would receive the weight of the arch-stones between the numeral letters IV and V. Now a very rude resolution of the forces at *c* and *e* will show, that with equal loads the pressure on braces in the direction *e k* or *e s* would be nearly equal to that on *c s*, opposed as it is by *c k*, on which the pressure would, by the same resolution, appear to be half of that on *c s*. But the direct and transmitted loads on *c* are together little more than double that which rests on *e*; therefore *c s* will receive a pressure not much more than double, and *c k* a pressure not much more than equal to that which *e s* or *e k* would sustain. But *c s* and *c k* are whole timbers, on

which account alone they are many times stronger than *e s* and *e k*, repeatedly and necessarily halved and mutilated. Then *c s*, which sustains the greater load, is very short, and in this gains an accession of strength, added to which, its nearly vertical position removes any considerable tendency to overthrow the pier. There can, therefore, be no doubt of the stability of the points *c* and *g*, without calculating on any assistance from the braces *o s o k*, or on the support which would be transferred to *c* and *g* from *b* and *h*, by the rods *b q h m*.

The requisite size of the rods is a matter of calculation; it is proposed that *s c c o*, &c. have a section of three square inches, all the others of one square inch.

A centre according to the above description would contain not more than one-third of the timber, and not half the iron consumed in those of Waterloo-bridge*. Such a diminution of material, if it can be safely effected, gives rise to a second series of advantages, among which economy, facility of setting and striking, accuracy of workmanship, and the avoidance of personal danger, would be conspicuous.

Whether so great a reduction be practicable, whether there be objections to so extensive and important a use of iron, nothing perhaps but experience on the large scale can satisfactorily determine.

The following is a detail of experiments made in presence of the Committee of Mechanics, on a model adapted to a semi-elliptical arch, having a span of fifteen feet and a versed sine of four feet four inches and a half. The

* From the best information I have been able to get.

load consisted of pig-iron previously weighed and marked, which was placed in scales suspended by stirrup irons from the points I, II, III, IV, V, VI, VII, and VIII *. An index was affixed to mark the changes in the form of the model, and the progress of the load made to represent the actual erection of a bridge. Inasmuch as the model was adapted to an arch one-eighth of the size of those in Waterloo-bridge, one sixty-fourth of the actual weight sustained by those centres is the largest that should have been applied to the model. This would give for each of the points—

	Lbs.
I and VIII, about	600
II and VII, about	900
III, IV, V, and VI, about	1200

making a total of 7800 lbs. The load actually applied exceeded 19,000 lbs.; before describing which particularly it must be stated, that the stirrup-irons suspended from I and VIII were connected at the lower extremities by horizontal rods, which constrained them to take a direction parallel to *b r* and *h l*. Those at II and VII were in like manner drawn into lines parallel to *c q* and *g m*. This constraint on the irons I and VIII, II and VII, caused the weights in the former to exert a pressure one-third, and in the latter one-fourth, greater than their actual value.

The following account of the progress of the load and

* For the opportunity of making these experiments, and for much valuable assistance in performing them, the Society is indebted to the liberality of Messrs. Lees, Cottam, and Hallen, in whose premises they were made and repeated.

its effects is extracted from the minutes of the committee:—

	Lbs.	
No. I was loaded with ...	714	No sensible change.
VIII.....	740	

The angle formed by the stirrup irons, Nos. 1 and 8, was such, that on resolving the forces the diagonal representing the actual force was 21, and the side representing the strain on the stirrup 27. The actual strains, therefore, on the stirrups, were between 900 lbs. and 1000 lbs.

The former loads being retained,

	Lbs.	
No. II was loaded with...	1240	No sensible change.
VII.....	1256	

For reasons similar to the former, these weights were equivalent to 1500 lbs.

The former loading all retained,

	Lbs.	
No. III was loaded with	1075	No appreciable change.
VI.....	1111	

The former loading still retained,

	Lbs.	
No. IV was loaded with...	212	The middle had now sunk twice the thickness of the line, or about 2-30ths of an inch.
V.....	310	
No. IV was then increased to	1311	The whole weight was now 8787 lbs. and the middle had sunk three-sixteenths of an inch.
V.....	1340	

It was now determined to try the effect of a still more excessive load on the haunches; for which purpose the loads were removed from Nos. II, III, IV, V, VI, and VII, and the bolts which had hitherto confined the model to the abutting pieces were cut away, in order to ascertain whether there was any tendency to slide up or down the inclined planes which supported the soles *a s i k*.

	Lbs.	
No. I was increased to...	1932	The strains in the direction of the stirrups, produced by these loads, would be for each about 2500 lbs.
VIII	1915	

There appeared, however, no tendency to slide on the abutments, but the crown rose one-tenth of an inch. The weight was now five or six times greater than could occur in practice, while there was nothing at the crown to represent the weight of the centre itself, and of the planking, bracing, and other extraneous matters. The first applied weights of 714 lbs. and 740 lbs. produced, as before stated, no effect.

The loads were afterwards increased till they were as follows:—

	Lbs.		Lbs.
I	1932	.....equal to.....	2500
II	1840	.....	2240
III	2406	.....	2406
IV	2173	.....	2173
V	2340	.....	2340
VI	2261	.....	2261
VII	1870	.....	2280
VIII	1915	.....	2500
Total..	16737	.....	18700

No alarming symptoms of distress were exhibited, and the model remained uninjured. The index had been accidentally deranged during the application of these last weights, and of consequence the greatest depression was never ascertained.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. A. AINGER.

PAPERS

IN

COLONIES AND TRADE.

No. I.

PLANTATION OF CLOVES IN THE COLONY OF TRINIDAD.

The sum of FIFTY GUINEAS *was this session presented to M.* LE CADRE, *of the Island of Trinidad, for his Plantation of Clove Trees. Samples of the Cloves were produced to the Society, and have been placed in the repository.*

SIR, Trinidad, May 12, 1824.

AN advertisement having appeared in the Gazette of this Island, stating certain premiums offered by the Society for the encouragement of Arts, Manufactures, and Commerce, and particularly some for the advantage of British colonies, as follows,—

"To the person who shall grow the greatest quantity

of merchantable cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, and equal to those imported from the islands of the East Indies;—the *Gold Medal*, or *Fifty Guineas*.

"Satisfactory certificates from the governor or commander-in-chief of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture; together with samples, to be produced on or before the first Tuesday in January, 1825:"

And having made, a few years past, some plantations of that description upon my estate here, I have the honour to address to you, as Secretary of the said Society, the certificates from the governor of this island, as required; and also of sending twenty pounds weight of cloves, the growth of the said estate (conformably to the said advertisement), to William Vaughan, Esq., with the bills of lading.

I am, Sir,

&c. &c. &c.

FS. LE CADRE.

A. Aikin, Esq.
Secretary, &c. &c.

CERTIFICATES.

TRINIDAD.

By his Excellency Sir Ralph James Woodford, Bart. Governor and Commander in Chief, in and over the said Island and its dependencies, &c. &c. &c.

RALPH JAMES WOODFORD.

THIS is to certify to all whom it may concern, that Francis le Cadre, Esq. is a resident planter of this Island, and that Edmonstone Hodgkinson Esq. is commissary of population, and acting surveyor-general.

Given under my hand and seal of office, at Government House, in Port of Spain, this 6th day of May, in the year 1824.

FREDERICK HAMMET,
Assistant Secretary.

SIR, Trinidad March 17, 1824.

HAVING observed that *the Society for the encouragement of Arts* has offered premiums for the cultivation of cloves and cinnamon in the West Indies, agreeable to an advertisement, as follows:

"To the person who shall grow the greatest quantity of cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas*.

"Satisfactory certificates from the governor of the

place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday of January, 1825."

I beg leave to address your excellency on the subject, and to lay before you the enclosed statement, in the hope that your excellency, after having ordered the examination of my spice plantations, will be pleased to grant to me the certificates required by the Society, so as to enable me to make application for the premiums offered.

I have the honour to be,

&c. &c.

FRANCIS LE CADRE.

To His Excellency Sir Ralph Woodford, Bart. Governor, and Commander in Chief, &c. &c.

THE commissary of population is directed to make the examination requested, taking to assist him Mr. E. Davis, assistant-gardener of the colony, (in the absence of Mr. D. Lockhart), and Mr. J. Wilson, gardener to the Cabildo.

RALPH WOODFORD, *Governor.*

Trinidad, March 17, 1824.

STATEMENT of certain spice plantations made by, and belonging to, the subscriber, a planter in the quarter of Diego Martin, in the said island of Trinidad, drawn up

for the purpose of applying to the Society for the encouragement of Arts, for the premiums offered as follows:

"To the person who shall grow the greatest quantity of cinnamon or cloves, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas*.

"Satisfactory certificates from the governor of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday of January, 1825."

Cloves.

One hundred and nine trees, nine years growth, 15 inches in circumference.

Average produce of each tree, two pounds dried, which is the result of six pounds green.

And large nurseries of young plants from one to six and a half feet high.

This plantation having been commenced with no other view than the disposal of its produce in this island, was not planted with the regularity observed in the East Indies, cinnamon trees having been intermixed at five feet distance, with the clove, and the former being much larger than the latter, of course their growth was checked, and the produce lessened: but as this species of culture is now encouraged to the mother country, with views no doubt advantageous to the planter, the mode of planting pursued in the Moluccas will be adopted in this part of his majesty's dominions.

Cinnamon.

ONE thousand trees, nine years growth, and large nurseries of young plants.

The former are planted as the clove trees, they are thirty-six inches in circumference, but they grow larger when planted separately, the subscriber having a few above forty inches in girth.

The cinnamon is thicker than that from Ceylon, but that which is made from the sprouts of the trees after they have been cut down at twelve or fifteen inches from the ground, is much thinner, and of a superior quality, as the subscriber has been convinced of, from a few trees he cut down about four years past; so that he has no doubt that the Trinidad cinnamon will be soon much improved.

The cinnamon now in this island is the produce of six young trees imported; three from the botanical garden of Martinico, and three from that of St. Vincent, sent to Governor Picton, as Ceylon cinnamon. Several thousand pounds weight of it have been already imported from Trinidad, and a few days past 3018 pounds weight were shipped for Gibraltar, for consumption in the Mediterranean.

The subscriber, agreeably to the advertisement of the Society for the encouragement of Arts, sends twenty pounds of his clove, and an equal quantity of cinnamon, in the hope that the Society will give him the premiums offered.

F. LE CALRE.

Trinidad, Commissary of Population's Office,
April 14, 1824.

Sir,

In obedience to your excellency's commands upon the application of M. le Cadre, concerning the premium offered by the Society of Arts in London, for the cultivation of cinnamon and cloves in these parts of his majesty's dominions, I have the honour to report to your excellency that I repaired to the plantation of that gentleman, situated in the quarter of Diego Martin, accompanied by the colonial gardener and the gardener of the Board of Cabildo, and having particularly examined the same, we respectfully submit the following observations.

There are 109 clove trees in bearing, and upwards of 1000 cinnamon trees, with large nurseries of both, particularly of the former; those which are in bearing are about nine years old; they are both hard woods.

The clove almost produces its own nurseries, as the seeds take root merely by falling on the ground; if planted deeper it will perish. The clove at all times requires some, but while young it needs a very thick natural shade. M. le Cadre frequently tried artificial shade, but the seedlings always died under it. The plant is altogether the most delicate and difficult to raise that is known in this country. When ground is destined for a nursery, it should be carefully prepared by freeing it of roots and stones, and the bed should be raised a few inches to prevent the rains from washing away the earth from the roots of the young plants.

The transplantation may take place when the seedling is about nine months old, and about a foot or eighteen inches high; those I speak of are about ten feet asunder, having

a cinnamon tree between each, and shaded, as the cocoa is, with bois-immortel.

The cloves at M. le Cadre's having been partly planted on flat, and partly on rising ground, afford a strong proof that the latter situation best suits the plant, probably from its superior dryness, and the quick drainage of the rain water. The two plantations are not distant from each other; the soil is the same, about three parts strong loam and one part sand. The shade on the low land is closer, those on the hill are rather exposed to a northern aspect, not the most favourable in this country; the trees are all of the same age, about nine years, and yet the latter are nearly a fourth larger than the former, besides having foliage of a deeper green hue, and possessing altogether a more healthy appearance, being about twenty inches in girth at six feet from the ground, while those growing on the low land are about fifteen to sixteen inches round at the same height; they are about twenty feet high. Manure has not been used to any part of this plantation, nor would it perhaps be advantageous at any time, on the generality of soil in this new country, where, having been good when first put in cultivation, it is preserved from wearing out by the shade and the droppings of the leaves.

From what is above observed it is evident that the clove thrives best in a dry soil, and requires little more moisture than its shade furnishes and keeps up. For transplantation, in common with other plants, a moist season should be chosen; and of aspects, it is well known that in this country all vegetation thrives best upon that which is to the westward, and is sheltered from the trade wind.

These clove-trees began to bear at seven years of age,

and produced the fruit in the month of February: it is picked in the month of March; but any left for seed remains, and continues to grow till the month of June, when it has greatly increased in size, and falls off ripe. It is so very delicate a germ that it should be sown as soon as possible, and not later than thirty-six hours after separation from the tree.

The produce of those trees is now about six pounds of green cloves, which dry up to about two pounds of merchantable cloves per tree per annum; but the quantity of fruit would probably be greater were it not for the closeness of the cinnamon tree, which likewise, by causing it to grow tall, puts much of the fruit out of sight, and renders the gathering difficult; that which is beyond the hand is snapped off in the cleft of a long stick.

I am unacquainted with the treatment of this plant in the Spice Islands, but from comparison with the cultivation of others under our daily inspection, as cocoa, coffee, &c. it does not appear that those here are under the most judicious system of propagation; in all countries we observe fruits are so trained as to grow as little as possible beyond the reach of the hand, and except in the greater degree of delicacy in the clove plant, it is highly probable its cultivation could be very much assimilated to that of coffee, which, when its vertical growth is checked, extends horizontally, and is in every part within reach for any purpose.

This remark cannot be applied to M. le Cadre, who had not the advantage of any precedent to guide his exertions, who, in the perseverance which was requisite in saving 109 out of above 4000 plants, has accomplished a very

important colonial object, and one which may be a leading feature in its future history.

I have the honour to be, Sir,

Yours, &c.

EDMONSTONE HODGKINSON,

Commissary of Population,

Acting Surveyor-General.

His Excellency the Governor, &c. &c. &c.

THE Committee of Colonies and Trade having requested the opinions of dealers in spices, and of others conversant with the article, on the samples sent by M. le Cadre, were favoured with the following letters from Messrs. Tucker and Hunter, spice-brokers, and Mr. Jarman, warehouse-keeper of spices to the East India Company.

DEAR SIR, 39, Lime-street, March 11, 1825.

THE cloves, of which you sent us a sample, are very fine. We do not hesitate to say that they are superior to Bourbon, and, indeed, equal to Amboyna cloves in flavour, and nearly so in size. We have had many parcels through our hands of a similar description, the produce of Cayenne.

We never before saw a sample of cloves, the growth of a British colony in the West Indies; but, from the specimens now sent, we think that every encouragement ought to be held out for their extensive cultivation.

We are, Sir,

Yours, &c.

TUCKER and HUNTER.

Charles Copland, Esq.
2, James-street, Adelphi.

MY DEAR SIR, Leadenhall-street, April 12, 1825.

THE cloves you sent for my inspection are very fine. They are not so large nor so strong in flavour as Amboyna cloves (the best sort known), but are superior to the Bourbon clove, of which considerable quantities are annually sold in London.

I am, Sir,
&c. &c. &c.
WM. JARMAN.

W. Evans, Esq.
Chairman of the Committee of Colonies and Trade.

No. II.

EXTRACT OF MIMOSA BARK.

The GOLD CERES MEDAL was this session presented to Messrs. PETCHEY and WOOD, of Hobart Town, Van Dieman's Land, for making and importing five tons of Extract of Mimosa Bark, the growth of that colony.

CERTIFICATE.

I HEREBY certify to all whom it may concern that a certain liquid or extract, called the mimosa extract, made from the bark of the mimosa tree, the production of Van Dieman's Land, New South Wales, (fifteen hogsheads of which have been shipped by the manufacturers on board

the ship Guildford, Captain Johnson, proceeding from this port to England), is solely and entirely prepared and manufactured by Messrs. Petchey and Wood, at their manufactory in Davey-street, Hobart Town, Van Dieman's Land; and that the casks containing the same are branded P. and W., and numbered 1 to 15.

Given under my hand, at Government House, Hobart Town, this eleventh day of June, 1824.

GEORGE ARTHUR,
Lieutenant-Governor.

THE extract imported by these candidates is not almost dry, like that prepared by Mr. Kent (see vol. 42, p. 176), but is of the consistence of tar or treacle; it is without the smallest degree of empyreumatic flavour, and is wholly soluble in cold water, which Mr. Kent's is not. It contains at least as large a proportion of tan as extract of oak bark of similar consistence, and will, no doubt, be very acceptable to our tanners.

It is prepared by the same process as that described by Mr. Kent, as far as boiling the bark in water to make the infusion. When this boiling has continued twelve hours, the liquor is strained off; it is then boiled twenty-four hours, and again strained; and then boiled for twenty-four hours more, and strained. It is then cooled, and run into casks for exportation.

No. III.

MACHINE FOR ERADICATING THE STUMPS OF TREES.

The Gold Ceres Medal was this session awarded to J. Mackay, Esq., of Pictou, Nova Scotia, for a Machine for eradicating the Stumps of Trees.

Sir, Pictou, Nova Scotia, Dec. 15, 1823.

In consequence of a notification in the Gazette of this province, that the Society of Arts in London have offered a premium to the person who shall invent and discover to the Society the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees, which have been left after felling the timber, I have been induced to communicate to you the following mode, which I trust you will have the goodness to communicate to the Society.

As in the clearing of woodland the extirpation of stumps and roots is the most laborious part of the process, it has, of course, been the subject of much attention in this quarter of the globe. In British America the ordinary method of clearing land is, to allow the stumps to remain for a number of years, according to their size. During this period the smaller fibres gradually decay, and the root itself is each year removed a little from its original position by the intensity of the frost. When the farmer

judges that time has so far produced decay as to render the removal of the stumps and roots practicable by the usual means, he pitches upon the spring of the year, when the soil has been loosened by the returning heat, and with the assistance of four or five men and a couple of pairs of oxen he effects his purpose. The oxen are fastened by a chain to the top of the stump, and when the removal of it exceeds their strength, the men are employed in aiding them by levers, or in cutting off the larger roots, which are afterwards taken out by themselves. Here it may be observed, that though the softness of the ground produces a considerable saving of power, there is much lost on the part of the oxen from their want of a firm footing, and also in the lever, as a very small pressure forces its fulcrum into the soil. Besides, it frequently happens, that the fulcrum, by resting upon the roots, deprives the lever of much of its power.

The block and tackle have been sometimes employed, but their use is both laborious and expensive. I at one time imagined that a purchase-cart, such as is employed in his majesty's naval yards, might be used with advantage. It is, however, in no respect different from the lever; and in the spring, when the ground is soft, the sinking of the wheels would render it inconvenient. The following is, I believe, the cheapest and most effectual method which has yet been employed in this part of the world.

In 1821 I had purchased a field of ten acres, from which, in the course of the winter, I cut down and removed the timber. As it was a natural forest, the trees of course were of various sizes: the largest, I think, were about thirty inches in diameter. Having at that

time a ship's winch in my possession, it occurred to me to use it for clearing my field, and the result far exceeded my expectations. With the assistance of four men I found myself able to raise, on an average, eighty stumps a day, and with them every root which could impede the progress of the plough. After they are removed from their bed they must be, in the ordinary way, cleared of the adhering earth, collected into piles, and destroyed by burning. Mr. David Creighton, a gentleman of this place, encouraged by my success, was induced to adopt the same mode, and in the space of six days cleared a field containing three acres, in which the timber was such as I have previously mentioned. This method, I am satisfied, might be generally used with advantage. The expense of the whole apparatus does not exceed twenty pounds, and with moderate care it would last as many years.

In clearing my field I pitched upon a piece about the size of an acre, into the middle of which I brought the winch, and fastened it to the largest stump. From the barrel of the winch a chain proceeded, which extended to the farthest stump in the piece: this was of the size usually attached to a winch when it is used in vessels. I had also provided myself with a number of shorter chains, having each a ring at one end and a hook at the other. By passing the hook through the ring, these were fixed upon the stumps nearest to that to which the chain of the winch was attached, and when it was raised these chains were in succession hooked to the leader, so that the winch was employed, without interruption, till the nearest stump was extracted. In clearing my field five hands were engaged; two at the winch, two in fixing the

chains, and one at the stump to be raised. When the stump was large, those who attended the chains occasionally assisted in turning the winch. I would only further observe, that where stumps are of a large size, what is commonly termed a snatch-block might be used with advantage.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. JOHN M'KAY.

CERTIFICATES.

Pictou, Dec, 15, 1823.

I DO hereby certify, that I have used the winch with much success in clearing my field, having taken out in one day, with the assistance of four men, more than I could do with twenty men in the same time, and upon the old principle. With four men, in the space of six days, I completely cleared three acres of land, where the stumps were large and numerous, many being upwards of two feet, and very few less than one foot in diameter, The above I am willing to certify upon oath, if required.

DAVID CRICHTON.

WE, the subscribers, do certify unto all whom it may concern, that we have witnessed the success of John M'Kay, Esq. in raising and removing stumps by means of the winch, and we conceive it to be the most effectual method with which we are acquainted. We are also

satisfied, that five or six men will in this manner raise and remove more stumps than twenty would by the mode usually adopted in this country.

HUGH DENOON,
GEORGE JOHNSTON,
JAMES KILLEL,
DAVID CRICHTON,
JOHN W. HARRIS,
WILL. RANKINE,
GEO. CAMPBELL,
JOHN TAYLOR,
DAVID UNDERWOOD,
WILLIAM CORBET.

Province of Nova Scotia, Halifax. } I, Samuel George William Archibald, notary public, duly admitted and sworn, dwelling at Halifax, in the province aforesaid, do hereby certify unto all whom it doth or may concern, that the names Hugh Denoon and George Johnston, to the foregoing certificate subscribed, are of the proper handwriting of them the said Hugh Denoon and George Johnston, and that they are two of his majesty's justices of the peace for the district of Pictou, in the province aforesaid; and that all faith and credit is due to their acts and attestations.

In witness whereof I have hereunto my hand and seal of office subscribed and set, at Halifax aforesaid, this 26th day of December, 1823.

G. W. ARCHIBALD,
Notary Public.

Reference to the Engraving of Mr. John M'Kay's method of removing Stumps and Roots of Trees.

PLATE XVII. fig. 1. *a a* the two winch handles of the frame *b b*, which is chained to the largest stump *c*. *d d* the leading chain, proceeding from the barrel to a distant stump *e*. The stump *f* has just been raised, and the chain removed to the stump *e*, which is in the act of being raised (as much chain as pulled up the former stump remains round the barrel). *g* a shorter chain round the stump *h*, to be hooked on to the leading chain *d d* as soon as it has raised the stump *e*, and has been disengaged from it, so that the different stumps are raised in succession, from the farthest to the nearest. The winch is then moved to face the next portion, and the chain again extended to the farthest it can reach, while the shorter chains are attached to the right and left stumps, and hooked on in succession to the leading chain, and thus continued till a whole circle round the winch has been cleared. Should the stump to which the winch is attached be liable to give way, it will be requisite to lash it to one or two in the rear, to secure the purchase.

Fig. 2 shows a bird's-eye view of the end of the chain *d d*, secured to a stump with two short chains *g g*, secured to neighbouring stumps ready to be hooked on.

APPENDIX.

No. I.

CAPTAIN BAGNOLD'S STEAM CULINARY APPARATUS.

In the last volume of the Transactions a description is given of Captain Bagnold's steam boiler, adapted to culinary purposes. The mode of securing the cover of the boiler having been omitted, that deficiency is supplied by the following description.

Plate XVII. fig. 3. *i i* the neck of the boiler, and *j j* the cover, shown in section. This cover has a groove or channel all round it, into which the neck *i* enters, and fits tight by means of a little cloth packing; *j j* the outer rim, and *k k* the inner rim; *l l* a bar which slides loosely in the staples *m m*; *n* a screw fitting loosely in a square hole in the bar *l*, and kept from falling out by the pin *o*; the screw *n* passes through a hole in the cover, and the nut *p* secures the lid tight down.

Fig. 4. An under or inside view of the neck, showing the staples *m m* and bar *l l*.

No. II.

MR. JAMES JONES'S KILN FOR DRYING CORN.

Sir, 150, High Holborn, Nov. 30, 1825.

I beg leave to trouble you to lay before the Society of Arts the inclosed addition to my communication on the subject of the vertical kiln; together with a certificate from a gentleman who has had the greatest experience in the use of them.

I am, Sir,

&c. &c. &c.

James Jones.

A. Aikin, Esq.
Secretary, &c. &c.

Since I had the honour of receiving the Society's reward for a vertical kiln (see vol. xli. p. 165), I have had some additional experience, which has enabled me to make such alterations and improvements as I conceive it proper to make the Society acquainted with.

In my communication the kilns are described as being constructed entirely of iron, but after experience showed it to be an improper material, as oxidation of the external cylinder and cones were found to take place, by which (independent of the decay of those parts) the perforations became partially stopped: this effect was also encreased by another cause: for the purpose of preventing oxidation, I have had the external surface rubbed with a mixture of black-lead and olive oil, but the dust from the wheat adhering to it also partially stopped the holes, and in many places these

joint causes closed them entirely, so as to occasion the necessity of pricking them open, as the quantity of work done was necessarily much diminished. This, together with the evident decay, compelled me to resort to a material not subject to destruction by damp, for the external parts; but for the internal parts it was not requisite to make any change, as I did not find the iron subject to the slightest alteration. After a good deal of consideration, I determined to try a compound for which a patent has been obtained by a Mr. Christopher Pope, of Bristol, consisting of lead, tin, and zinc, and which answered perfectly, with the single exception of being rather softer than is desirable. The advantage derived from the use of the new material was very obvious in the last kiln I erected, which was also three feet higher than the preceding ones. It stands in the same house as the second one which was made, and on account of its retaining its full degree of perforation, and its greater size, dries more than the other in the proportion of five to three and a half, each consuming the same quantity of fuel. Another advantage also results from the same cause; namely, the facility afforded to the escape of the insects through the holes, being driven out by the heat; and I have seen good flour produced from wheat, which, if dried in any other way, could not be ground, in consequence of the immense number of maggots it contained, but which, by this mode of drying, were effectually separated. I have also found it advisable to discontinue the perforation of the inner bottom cone, as then all the dust and insects which are screened out by the inside top cone, are retained in the bottom, and prevented from again mixing with the wheat.

In the fire place, I have not made any change, but have placed it further inside, so as to set it in the centre;

an arrangement which also affords an opportunity of contracting the width of the entrance, by which the angle of the upper part is made more acute, thereby offering less obstruction to the descent of the grain. But this alone is not quite sufficient, for wherever an obstacle is presented, however small the angle may be, the flow of the grain is in some degree checked. To remedy this I have placed over the inclined sides of the entrance-frame a second inclined plane, perforated with large holes; this secondary plane allows the grain to pass through and descend down the first one, at the same time sustaining the pressure of wheat immediately over it, which would otherwise prevent, in a great measure, the descent down the angle.

That the kind of drying effected by the vertical kilns is superior to the ordinary mode, is very satisfactorily proved by the circumstance of the bran being brought out from three to four pounds per bushel lighter than from any other mills in the neighbourhood, being on the average eight pounds per bushel, which difference is evidently an additional profit of so much flour, and at the same time the flour in highly approved on account of its superior quality.

For the Society's greater satisfaction, I beg leave to enclose a testimonial from E. F. Howis Esq., the proprietor of large mills at Crowborough, in Sussex, for whom I have erected three kilns, viz., two for wheat, and one for oats, pease, &c.

CERTIFICATE.

SIR, Crowborough Lodge, Sussex, Nov. 25, 1825.

THE kilns, which you have erected for me at this place, fully answer the utmost expectations I had formed

therefrom: they each dry thirty quarters of wheat at the expense of two bushels of coals, in the time of a common working day at this season of the year, and I doubt not if the kilns are kept at work night and day, which as a measure of economy should be the case, more than double thirty quarters would be dried. I consider your kiln of great utility, and most sincerely hope you will derive all the advantage you merit from the discovery thereof.

You are perfectly at liberty to refer any gentleman to me upon the subject of your kilns, as I shall feel most happy to assist towards their general adoption.

I am, Sir,

&c. &c. &c.

E. F. Howis.

To Mr. Jones, Jun., Holborn.

No. III.

PREVENTION OF FORGERY.

The Thanks of the Society were presented to Messrs. Perkins and Heath, for their liberal compliance with the wish of the Society to be furnished with one of their most recent and improved Specimens for Bank Notes. The following letter was received on the subject from those gentlemen.

Sir, 69, Fleet-street, Dec, 19, 1825.

In submitting to the consideration of the Society for the encouragement of Arts, Manufactures, and Commerce, specimens for their renewed Report upon the prevention of Bank-note Forgeries, we deem it unnecessary to make

many remarks, inasmuch as the subject was very fully discussed in a communication we had the honour of forwarding to your Society in 1829, and which was inserted in vol. xxxviii of the Transactions. The experience we have since had, tends, if possible, still more firmly to convince us, that the best security for bankers' notes against forgery is to be found in a combination of the talents of the greatest number of first rate artists (which may be practicable) in the formation of a note. With this view we have sent you the two plates that appear in your present report, and which do not contain more elaborate work or security than many notes now actually in circulation that we have executed for country bankers.

The plate with the writing upon it is of course intended for the face, and that without writing for the back of a note, the two together being intended to represent but one note.

With these brief remarks we leave it to those interested in the subject to judge, whether, if a forgery of such a note were attempted, it would be practicable to succeed in such a manner as to pay any thing like the expense incurred in the undertaking. To prevent misapprehension, we may be permitted to remark, that a note similar to the specimen would be produced at our usual prices, as our desire to increase the difficulties of forgery has ever induced us to charge the same price for a superior as for an inferior description of note.

We are, Sir,

&c. &c. &c.

PERKINS & HEATH.

A. Aikin, Esq.
Secretary, &c. &c.

OBSERVATIONS ON THE CULTURE OF SILK.

BY THE LATE ARCHIBALD STEPHENSON, ESQ.
OF MONGREENAN, IN AYRSHIRE.

The public attention having of late been particularly called to the possibility of growing Silk in the British Islands; the Society have been induced to direct the publication of the following observations. They have been for several years in the Society's possession; but being the result of actual practice and careful observation, will be highly acceptable to those who are about to direct their capital into this new channel of industry.

HAVING resided for five years in the provinces of Languedoc and Quercy, in the south of France, where the utmost attention is paid to the culture of silk; I embraced that opportunity of observing with care, the manner in which this lucrative branch of manufacture and commerce was carried on: and, indeed, I was led to bestow the more attention upon this important subject, from an idea I entertained, that this valuable culture, by proper care, might certainly be introduced into Great Britain, particularly in the southern parts of this island, where there are large tracts of land, which would answer perfectly for the production of the mulberry tree, and which, from the nature of the soil, can never be employed to any great advantage in raising of corn.

To show in some measure, that this object well merits the attention of this country, it may not be improper to mention that from a memorial in relation to the culture of

silk in France, drawn up for the inspection of the French minister, and of which I was favoured with a perusal, by the author thereof; it appeared that the value of the raw silk raised in France in the year 1764, amounted to no less than thirty millions of livres; and it must naturally be supposed, that the value of it must now be encreased considerably, as the culture of silk has been extending itself rapidly towards the more northern parts of the country since that period.

Having with great pleasure observed the progress which has been made by the Society of Arts, &c., with a view to introduce this valuable culture into Britain, I must beg, as a mark of the high respect in which I hold the Society, for their unremitted attention to every object which can serve to promote the prosperity of this country, to be permitted the honour of laying before them the following observations in relation to that culture, which I collected during my residence in France; and shall reckon myself particularly happy, if any of them shall be found to be of use to them, in the prosecution of the truly patriotic views of the Society.

1st. It appears proper to begin, by giving some little account of the mulberry tree, since, as the Society justly observes, this is the first object which claims our attention: because we must first of all make some provision of food for the silk worms, before any trial at large can be carried into execution with any propriety, or indeed, with any rational hope of success.

There are two kinds of the black mulberry tree which have been cultivated in France. The first of these bears a fruit well known, and frequently presented at table, being the same which is cultivated in our gardens in the neighbourhood of London. But the leaves of this tree have

been found, from experience, to be too harsh and too succulent, to prove in every respect a proper food for the silk worm; and the silk it yields turns out to be coarse, and of an inferior quality.

The second kind of the black mulberry tree carries a fruit inferior to the other in point of size, and improper for the table: but the leaf of it has been found to be superior to the first, as food for the silk-worm; and it is less harsh, less succulent, and yields silk of a finer quality than the one first mentioned.

This second sort of the black mulberry is, in all probability, the particular kind, which is said to be at present cultivated in the kingdom of Valencia, in Spain, for the use of their silk-worms: and, indeed, many of their old plantations in France, consist of this sort. But their new plantations consist wholly of the white mulberry tree, hereafter to be mentioned, which is the only one they now cultivate in all their nursery grounds, for the use of their silk-worms; so far at least as I had occasion to see them.

There is a third sort, known by the name of the white mulberry, the leaf of which is more tender and less succulent than any of the other two, and has been found to produce silk of the finest and best quality.

Some people, I find, have been led to think, that this kind of the mulberry tree does not carry any fruit, and that it can only be propagated by layers; but in this particular the fact stands much otherways. For, though the white mulberry may not perhaps produce any fruit in a climate so far to the north as ours, which, however, I do not take it upon me to say is the case; yet the truth is, that in climates such as that of the south of France, this tree carries fruit in very great quantities, though it is of a

smaller kind than either of the two already mentioned. It is of a dusky white colour, rather inclining a little to the yellow; and contains a number of small seeds, like mustard seed; from which large nurseries of this valuable tree are now annually raised all over the southern parts of France.

For a number of years after the culture of silk was introduced into France, the people were accustomed to employ the leaves of all the different kinds of mulberry trees before mentioned, promiscuously: and some grafts of the white mulberry from Piedmont, and from Spain, which carried a larger leaf than the one they had got in France, having been obtained from these countries, these grafts were put upon French seedling stocks, which had the effect of increasing greatly the size of the leaves, and was regarded as an acquisition, as it certainly produced a larger stock of leaves as food for the worms. The consequence of which was, that this practice of grafting prevailed for a great many years all over Provence and Languedoc.

But Monsieur Marteloy, a physician at Montpellier, who had made the culture of the silk-worm his particular study for a number of years together, at last made it clearly apparent to the conviction of every body, by a regular course of attentive and well-conducted experiments, that the leaf of the seedling white mulberry was the food of all others the best for this valuable insect; as the worms which were fed with this particular leaf were found to be more healthy and vigorous, and less subject to diseases of any kind than those that were fed upon any of the other kinds of leaves above mentioned; and that their silk turned out to be of the very best quality. Since that time, namely, 1765, a decided preference has been given to this particular leaf beyond all the others.

As our British gardeners are, in my opinion, more intelligent in their business than any of the French gardeners, at least whom I had occasion to meet with in France, it may, by some, perhaps be reckoned unnecessary for me to say any thing here, with respect to the culture of the mulberry tree: but when it is considered that the culture of this tree has been so anxiously attended to in France, for a long period of years past, and that I do no more than justice to the French gardeners, when I say, that they succeed perfectly in this culture, it may not be deemed altogether improper for me to add here the method I observed to be used in France in cultivating the mulberry tree.

I shall therefore go on to observe, that their first object is to make choice of a spot of ground for their seed bed, of a gravelly or sandy soil, which has been in garden culture, or under tillage for some time, and which they know to be in good heart. When this ground is thoroughly dressed, they make drills at the distance of two feet from each other, in which they sow the seeds, in the same manner as they usually do lettuce for salads. They then cover the seeds lightly with some of the finest earth, after putting it through a sieve; and if the weather happens to be dry, they water it slightly once or twice a week, as they judge to be necessary. These seeds they sow as above, at any time from the end of April to the end of May, and even during the first week in June; and I observed that some gardeners, the better to ensure success, were in the practice of sowing the seeds at three different times during the same season: to wit, the first sowing in the last week of April; the second about the middle of May; and the third in the beginning of June.

When the plants are fairly above ground, they take

particular care to keep them clear from weeds, and from time to time, to point with a spade or a hoe the ground in the intervals betwixt the different drills.

After remaining for two years in the seed bed, they take up the plants: such of them as are of the size of a writing quill, they plant out in the nursery grounds; each plant at two feet distance from each other in the row, and the rows at three feet distance from each other, that there may be room for cleaning and dressing the ground betwixt the plants. At transplanting, they cut off nearly the half the root, and also cut off the tops at about six or seven inches above the ground. All the other plants which are too small for the nursery, they plant out thick by themselves, to remain for another year, or two, if necessary: after which they plant them out in the nursery grounds as above. The most proper time for transplanting the mulberry tree is just after the fall of the leaf in autumn.

When the plants in the nursery are sprung, they take care to strip off the side buds, and leave none but such as are necessary to form the head of the tree.

If the plants in the nursery do not shoot well the first year, in the month of March following they cut them over about seven inches from the ground, which makes them come on briskly the year following.

When the plants are grown to the size of one inch diameter, they plant them out in the fields where they are to remain, making the pits where they plant them of the size of six feet square, and dressing the ground for twenty inches, or two feet deep.

During the first year of planting out, they leave the whole buds which the trees have pushed out on the top until the following spring, when they take care to leave

none but three or four branches to form the head of the tree; and as the buds come out, they take off all those which appear upon the body of the tree, from the bottom all the way up to those which are left to form the head of the tree; and for several years after, at the seasons above mentioned, they take care to open the heads of the trees, when too thick of wood, and particularly to cut off any branch which seems to take the lead from the rest, and to engross more of the sap than what falls to its share, that the different branches may increase equally as much as possible.

After the trees are planted out, and likewise while the plants are in the nursery grounds, they take care to dress the ground about the trees regularly three or four times a year, which greatly assists the trees to get on.

Here it is proper to mention, that it is the practice in France to plant out some of their young plants from the nursery by way of espalier, in some sheltered situation, in a garden, for example, where the soil is not over rich: and if it can be had, where the soil has a great proportion of gravel or sand; the intention of which is, to procure early leaves for the worms in their infant state; as these leaves generally come out more early upon dwarfish plants in a sheltered situation, than upon the trees planted out in a more open exposure; and upon this occasion they have also recourse for tender leaves to their young plants in the seed bed and nursery grounds.

Any quantity of the seed of the white mulberry can be obtained either from Montpellier or Marseilles, where it is regularly to be found for sale in the seed shops. And if you do not choose to trust entirely to the seed shops, a friend at either of those places may be applied to, who

will take care to procure for you the freshest and best seed. It may also be obtained by the same means from Spain; the seed from which country is even preferable to that from France, as the Spanish tree carries a larger leaf than that of France, and has the leaf equally tender and good as the other, when used from the seedling trees.

From the experiments carried on by Monsieur Marteloy, that gentleman made it fully appear that the leaves of the trees which grew in a rich soil were by no means proper food for the silk-worm, as they were too luxuriant and full of juice for them; and that the leaves of those trees which were raised in a gravelly or sandy soil, where no manure was employed, were greatly to be preferred.

From these experiments also, one of the reasons, and apparently the principal one, may now be pretty clearly pointed out, which rendered abortive the trials made in England, during the reigns of James I. and Charles II. for intoducing the culture of silk into Great Britain; though that reason was altogether unknown in England, at the times these different trials were made. It appears to have been only this, that they had no other food to give to their worms but the leaves of the black mulberry, carrying the large fruit usually presented at our tables, which is now altogether rejected in France as an improper food for the worms; and which was rendered infinitely more destructive for these insects by the trees which produced them having been all of them reared in the richest grounds in England, namely, in the garden grounds about London, which we know are in a manner yearly loaded with dung.

The mulberry trees ought not to be pruned the first year after planting out, for fear of making them bleed too

much; but in the second spring it is reckoned advisable to dress their heads, and to continue to repeat that dressing yearly, during the next ten or twelve years; taking care to make them hollow in the middle, so as to give a free passage for the air, and to render it easy to gather the leaves. After the first twelve years are over, it will be sufficient if a dressing of the same kind is regularly given to them once every three years. But as some of the branches may probably be broken annually, in gathering the leaves, care must be taken to prune all such branches as may happen to be thus broken, to prevent the trees from suffering materially by such accidents.

In planting out the mulberry tree in the field where it is to remain, care must be taken to cover the roots properly, so that the earth may not lie hollow upon them, which would injure the plant. They should also take care to prop the different trees with stakes, to prevent them from wind-waving; placing straw next the body of the tree, to prevent the bark from being hurt; and it will be proper also to surround them with briars or brambles to preserve them from all injury from cattle.

Here it is proper to remark, that the second crop of leaves which come out upon the mulberry trees, after having been stripped of their first leaves for the use of the silk-worm, are not allowed to fall of themselves in the autumn. They are gathered for the second time with care, a little before the time they would fall naturally, and are given for food to their sheep, and eaten by them with greediness, and by that means turn out to good account to the farmer. Before the culture of silk was introduced into that part of Languedoc which is near to the mountains of Cevennes, the peasantry over all that neighbourhood were

miserably poor, as their soil, which is mostly gravel and sand, was incapable of carrying crops of any kind of grain whatever. But as it was found, upon trial, to answer remarkably well for the mulberry tree, the people entered with great alacrity into the culture of silk; and they have succeeded so well in that lucrative branch, that from having been amongst the poorest, they are now more at their ease than most of the peasantry of that kingdom.

When I happened to be at Gange, which is within the district above mentioned, and which is remarkable for the manufacture of silk stockings, I was carried to see some mulberry trees, belonging to a farmer in the neighbourhood of that village, which were the first that had been introduced into that part of the country. The trees were remarkably large and fine, and little inferior in point of size to our elm trees of the middling sort. The people who obligingly attended me to show me these favourite trees, assured me, that a good many of the largest of them brought a return to the farmer's family of a Louis d'or each of them yearly.

As an encouragement to the small heritors and farmers to plant mulberry trees upon their grounds, the French government are at an annual expense in keeping up large nurseries of these trees in many different parts of the country, from whence the small heritors and farmers are liberally supplied gratis with whatever numbers of these trees they desire to plant out upon their grounds; and proper directions are ordered to be given along with the trees, by the gardeners who are charged with the care of these public nurseries, that the people to whom the trees are thus given, may know how to treat them properly. This beneficent public measure is attended with great

advantage to the country, as the poorer people are by this means saved from the trouble and expense of rearing the trees, until they come to be of a proper size for planting out in the fields, where they are intended to remain.

From the extension of the culture of silk over all the southern parts of France, there is a great encreasing demand yearly for the mulberry leaves; so that they are now become as much an article of commerce as any other vegetable production; the peasants with eagerness buying them up annually with ready money at the proper season for the use of their silk-worms.

This last circumstance has given great encouragement to gentlemen of property to raise extensive plantations of mulberry trees upon their estates; as they bring in a certain and steady revenue, with little trouble or expense to the proprietor, after the trees have once passed the risk of being hurt by cattle. And this improvement is of the more consequence, because the grounds that are found to be the fittest for production of the mulberry trees, which afford the best food for the silk-worms, being gravel or sand, cannot be employed with any advantage in the raising of corn, more especially where manures lie at a distance from them.

Grounds of the above description had formerly been in use to be planted with vines; but the returns from these were far from being equal to what is obtained from grounds of the same quality when planted with mulberry trees. As an instance of this, I shall take the liberty of mentioning the following particulars, which I had from a gentleman, on whose veracity I am certain I could fully depend. He told me there was a gentleman, a surgeon at Nismes, in Languedoc, who had a tract of very poor ground in that

neighbourhood left to him by his father; which, when it came into his possession, yielded him a rent of three hundred livres, which amounts in our money to twelve guineas and a half. As this gentleman observed that the culture of silk was extending itself rapidly over that part of the country, he planted the whole of his little property with white mulberry trees, the leaves of which, as his plantations advanced, he found he could regularly sell annually for ready money to the people in the town of Nismes and in the neighbourhood, who employed themselves in the culture of silk; and my friend informed me, that these very grounds, after having been only sixteen years planted, gave a return to the proprietor of twelve hundred livres yearly; amounting to fifty guineas of our money. This improvement having been carried on under the eye of the neighbouring heritors, several of them pursued the same plan with equal success; and some of them who had grounds of the same quality which had been long planted with vines, actually grubbed up their vineyards, and planted their grounds with the white mulberry; and here let me add, that the mulberry tree is long lived, there being many instances where they have stood perfectly good for above one hundred years.

When the young mulberry trees are in the seed bed, and even when afterwards planted out in nursery-grounds, and likewise for several years after they are planted out in the fields to remain, you must be careful every night, in the spring and summer seasons, to examine with care, all round your plants, for a little snail without a shell, which is very fond of the bark of these trees when young, and preys upon them prodigiously. These snails will cut over your young plants in the seed beds and nursery-grounds,

and will even continue to prey upon the trees till they are pretty old; and though they do not absolutely kill the trees when planted out, yet they hurt them greatly, and retard their growth. These snails, therefore, must be gathered up every night as above mentioned, a little after sun-set, which is better than in the morning, because the mischief they occasion is generally done in the night; and they must be burnt, or otherwise effectually destroyed; for if you do not kill them they will find their way again to the trees.

The winter of 1765 I passed at Montauban in Quercy, when the frost was so extremely severe that it not only destroyed the greatest part of their leguminous crops and almost the whole produce of the kitchen garden, but also many of their vines, fig, and olive trees, and a great part of the orange trees in their green-houses; yet that frost, with all its severity, did not occasion the smallest injury to the mulberry trees, nor to the eggs of the silk-worms. This frost continued for two months together, and was within two degrees and a half of the great frost in 1709. But what is still more remarkable, I was assured from the most respectable authority, that even the frost of 1709 did not cause the smallest injury to the mulberry trees, though it destroyed many of their vines, and almost their whole fig and olive trees all over Provence and Languedoc. From which two instances I think it may be fairly inferred, that we have no reason to dread any danger to the mulberry trees from the severity of our British climate.

I shall now proceed to give an account of the manner used in France for disengaging the seeds from the fruit of the mulberry, which requires a considerable degree of labour as well as attention.

Having gathered the quantity of fruit you propose to set apart for seed, which must be thoroughly ripe before it is pulled, you put the fruit into a large tub or vessel, where you cause a person to tramp and press it with his bare feet, in order to bruise the whole of it thoroughly, and by that means disengage the seed from the little pods or cells in which it is contained.

You must at the same time have in readiness another tub, which must be pretty deep, into which you introduce a piece of flat wood, which must be made to rest upon the sides of the tub, at the distance of six, eight, or more inches from the bottom of the tub, as you shall judge to be necessary for your quantity of fruit. This cross-piece of wood is calculated to support a round cane sieve, which is to rest upon it. This sieve, must be very fine, that is, the holes must be very small and close set together, that as little of the pulp of the fruit as possible may go through the holes along with the seed.

Things being thus prepared, and the tub filled so far with water that it may rise more than half way up the brim of the sieve, when placed upon the piece of wood, you then put a handful or two of the bruised fruit into the sieve, which you rub hard with your hands upon the bottom of the sieve, in order to make the seed pass through the holes, and every now and then you lift up the sieve with both hands, and shake it to make the water pass through it, which carries the seed along with it. Besides rubbing the fruit with your hand upon the bottom of the sieve as above, you also take it and rub it heartily betwixt the two palms of your hands, rubbing the one hard against the other; as it takes a great deal of work

and pains to get the seeds disengaged out of their little cells, which must be done effectually before the seeds will pass through the holes of the sieve.

This work must be repeated till you observe that the whole of the seed has passed through the holes of the sieve; after which you throw aside the pulp, and must proceed in the same manner with the rest of the fruit; till you have finished the whole.

You then take the sieve and piece of wood out of the tub, and pour off all the water, when you will find the seed at the bottom; but along with it a great quantity of the pulp, which has been forced through the holes of the sieve, in rubbing the fruit hard upon the bottom of it with your hand, as above mentioned.

I should have noticed, that all the seeds which swim upon the surface of the water, are light and good for nothing, and must, therefore, be thrown aside.

You then put the pulp and seed, which you find mixed together at the bottom of the tub, into another vessel, and fill the tub with water as at first, having put the piece of wood and the sieve in their proper places as before, after which you pass the pulp and seed, by degrees, through the sieve, by rubbing it with your hand upon the bottom as before, and lifting up the sieve from time to time, with both hands, and shaking it, as already mentioned. In passing it this second time you will disengage a great quantity of the pulp, which you throw aside from time to time, as soon as you observe that none of the seed remains amongst it.

You then pour off the water as before; and if you find that there is still some of the pulp remaining with the seed,

you must pass it a third time through the sieve, which will effectually clean it, if your sieve is fine enough.

If your sieve is too coarse, that is, if the holes are too large, it will occasion you a great deal more work, as you will be obliged to pass it oftener through the sieve, since that operation must be repeated till the seed is perfectly clean; after which you must spread the seed upon a clean cloth, and expose it to the sun, till it is thoroughly dry. Three days, or even four days of a full sun are necessary to dry and harden the seed properly for keeping.

Upon this part of our subject it seems proper to add, that in a cool moist country, such as about Paris or London, it is reckoned the mulberry tree carries a double, nay, nearly a triple quantity of leaves to what it can do in the hotter or drier climates, such as that of the south of France, which is judged to be owing to the moisture of the climate, and the superior richness of the soil. In a cold moist climate, a person is not able, even with the utmost care, to produce above the half of the cocoons from the same quantity of eggs which can be done in a warmer and drier climate. But as in the colder climate the mulberry tree carries nearly three times the quantity of leaves, which it can do in the other; from thence it arises, that the colder climates, such as those before mentioned, are able, upon the whole, to raise at least as much silk, from the same quantity of eggs, as the warmer countries; because the quantity of food is the great article, as the grain or eggs of the silk-worm can easily be multiplied to as great a quantity as you please.

II. Having thus gone through the articles of greatest importance, so far as they occurred to me, in relation to the first and leading branch of our subject; the next which naturally falls to be considered, is the method observed in France in hatching the worms. But before proceeding to this article, it may not be improper to premise the following particulars, as they seem justly to demand a very particular attention.

Here then I must observe, that the greatest care ought to be taken to procure healthy good seed or eggs, because it has been ascertained from repeated experience, that the eggs from those houses where the worms were infected with bad air, carries along with it to the worms produced therefrom, the same distempers to which the worms of the preceding year were subject.

The eggs, in order to be properly preserved, should be kept in some dry place, with a free air not too hot; and that you should avoid keeping them in any vault or cellar under ground; because any kind of damp is found to be destructive to them.

The eggs of the silk-worm have been found to degenerate in the space of five years; hence a change from time to time is judged to be necessary, taking care to have the eggs brought from a warmer to a colder climate. This, however, must be done by degrees, and not carried at once from one extreme to another. For example, eggs brought from the Levant, the isle of Cyprus, or from other countries of the same latitude, ought not to be brought at once into such a cold climate as that of Flanders, or the north of France; but should be first brought into such a climate as that of Provence or Lan-

guedoc, from whence, after having remained there for two years, it can be brought with safety into the colder countries.

The first year that the eggs are brought from a warm to a cold climate, you must not expect great success from them: on the contrary, you will find, though the utmost care and attention are given to them, that the greatest part of the worms will die. But still you will be able to save enough to stock yourself sufficiently with eggs, which every succeeding year will be found to answer better as the worms become naturalized to the climate, which can only be brought about gradually; and indeed more time will be requisite for this purpose in Britain than in France, as the climate upon the continent is more fixed and steady than with us in England.

In transporting the eggs from one country to another, especially when this is done by sea, you must order them to be put into a bottle, which ought not to be filled more than half full, that the eggs may not lie too close together, which might run the risk of heating them, and causing them to hatch. The bottle being but half full, leaves sufficient room to the eggs to be tossed upside down, by the motion of the vessel, which keeps them cool and fresh, and hinders them from heating. After putting the eggs into the bottle, let it be carefully corked; a cover of leather put over the cork; and let that be sealed, to prevent any danger of changing the eggs. When corked and sealed as above, put the bottle into a double case, or box of wood; not only to preserve the eggs from all damp from the sea, or otherways, but also to protect them from too much heat, which would cause them to hatch. If

the bottle is too full, the eggs will lie too close upon one another, and will in that case heat of themselves, and hatch, and consequently in both cases must be lost.

The eggs that are duly impregnated by the male butterfly, are of a grey cindery colour, which colour they preserve till they are properly prepared for hatching, as after-mentioned. The eggs which are not duly impregnated, are readily to be distinguished from this circumstance, namely, that after having been kept for some time, they always continue to be of a yellow colour; and I need scarce add, that all such eggs are good for nothing, and ought therefore to be thrown away. There is no distinguishing betwixt good and bad eggs, but by the change of colour, after being kept for some time, as above-mentioned.

One ounce of eggs will produce 40,000 worms; and so in proportion, for a larger or smaller quantity.

These things being premised, I shall now proceed to describe the method I observed to be used in France for hatching the worms. In order to avoid the loss which must necessarily follow, if the mulberry leaves should happen to be destroyed by frost, after you have begun to prepare your eggs, they reckon it advisable to divide them, and prepare them for hatching at two different times, at the distance of ten or twelve days, the one after the other.

The advancement of the season determines the time of preparing your eggs for hatching, as you proceed to that as soon as you observe that there is a prospect of having a sufficient quantity of food for your worms, by the advancement of the leaves of the mulberry. But in order to be properly prepared for this work, you must begin a month before the usual time of hatching; first, to put your eggs in little divisions, from half an ounce to

an ounce, which you must place upon a piece of clean white paper, upon plates, for example; and put those plates containing the eggs in a place a little warmer than where you had kept them during the winter; for example, if you have an alcove bed, place them upon the shelf within the alcove. Let them remain in that situation for the first five or six days, after which you must prepare some little chip boxes, perfectly clean and neat, seven inches long, four inches broad, and four inches high, and cover them on the inside with clean white paper, into which put the different divisions of your eggs, having a small box for each division, and place these boxes in a basket, upon a stool, or chair, at the foot of your bed; making one of the mattresses of your bed go underneath the basket; and cover the basket on the top, first with some cover of woollen cloth, which pin close over it, and above that place a bed cover above all, so as to keep in the heat communicated by the mattress to the eggs; in which situation let them remain for six days longer; after which increase the heat to 14 degrees of Reaumur's thermometer, preserving that heat equal, night and day, by means of a little fire in some corner of the room at a distance from the bed.

In the morning when you get up, put a heater of one kind or other; for example, a tin bottle with hot water, or a foot stove, into your bed betwixt the sheets, and proportion that heat so as to equal the heat you give to the bed, when you lie in it yourself; keeping up the same heat as nearly as you can, until you go to bed again yourself in the evening.

Having kept them in this situation for eight or nine days, you must then put your different divisions of eggs

into little pieces of old linen cloth, which must be washed thoroughly clean for that purpose, as the least dirtiness in the cloth would prove prejudicial to the eggs; each piece of cloth should be of the size of a foot square: turn up the ends of the piece of cloth, and tie them with a bit of thread, as near to the top or end as possible; by means of which the eggs will lie loose, and can be shook, and turned from time to time, without untying the knot: replace these packets in the basket, and cover them up as before, turning and shaking the seed in the packets three or four times a day, that it may receive the heat equally.

On putting the eggs into these packets, increase the heat to 14½ degrees of the thermometer, and keep up that heat night and day, as equally as possibly; for which purpose, have a couple of thermometers in your room for your direction. After the eggs have remained in the little packets for three or four days, increase the heat to 15 degrees; and in four days more, if the weather seems settled, and very promising, increase the heat gradually to 16 degrees, visiting and turning the eggs from time to time as before.

When the eggs begin to turn white, and the mulberry trees are so far advanced as to be out of danger from cold winds, or slight degrees of frost, increase the heat gradually to 17½ degrees, or 18 degrees at most, to quicken the hatching of your eggs, and to make the worms come out as nearly at the same time as possible. But never increase the heat to more than 18 degrees, because a greater heat never fails to push the worms too fast, and to render them red at their first coming out.

When the worms are red at their first coming out, it is a sign the eggs have either been bad, or ill kept over winter, or overheated; that is, too much forced when laid to

hatch. Worms of this colour are good for nothing, and are therefore to be thrown away, to avoid the expense of feeding them, since they will never produce cocoons.

When the worms are entirely black, upon their first appearance, it is a sign of their having been perfectly well managed, which gives great hopes of success.

When the eggs first begin to take a white colour, put them into little chip boxes, and cover each box with a bit of clean white paper, pricked with many little holes in it, to allow the worms to come through, taking care to inspect and shake the eggs from time to time in the boxes, that they may have equal access to the heat; and when the worms are ready to appear, put a few mulberry leaves upon the paper, to which the worms will readily attach themselves as they come out; and, by means of the leaves, you can easily take out the worms as they appear, in order to put them into different little boxes, and then give them some of the tenderest leaves, cut into small pieces, to feed on, giving them at the rate of three meals each day.

As the leaves when very young will dry so much, even in an hour's time, if exposed to the open air, as to be unfit for the use of the young worms, you must put them into a clean glazed pot; but take care to place them loose, that they may not press too much upon each other; cover the head of the pot with a wet linen cloth, and place the pot in a vault or cellar; or, in case you have none, into the coolest part of your house; by which means the leaves will keep fresh and good for two or three days together. Besides, you must take care to have always in the house at a time, a stock of leaves sufficient at least for three days provision for your worms, to secure you in food for them during such length of time, in case of wet wea-

ther; as nothing is more pernicious to the worms than giving them wet leaves for their food; for which reason be careful never to pull the leaves when wet, either with rain or dew, except on absolute necessity; and in that case you must spread them out, and turn them, from time to time, with a long wooden fork, that the leaves may be perfectly dry before you give them to the worms.

It may here be added, that it is the general opinion in France that the leaves afford a more wholesome food for the worms when they have been gathered four or five hours than fresh from the tree; and more particularly so if the trees grew upon any soil other than sand or gravel; because the keeping them so long so far diminishes the over-richness of the leaf. The persons employed in pulling the leaves must be careful to have their hands clean, and free from every strong offensive smell, such as that of garlick, onions, or tobacco, &c.; and they ought to be particularly attentive not to bruise the leaves in pulling them.

When your worms are first hatched, keep each day's production separate by themselves, as it is of high consequence to have each parcel brought up as equal as possible, that all the worms contained in it may be in readiness to mount for making their cocoons at one and the same time. After setting apart separately the production of each of the first four days, what then remains of the eggs to be hatched may be thrown away, as these later worms are always found to be weakly, few of them completing their cocoons; so that the attempt to rear them is always attended with an unnecessary waste of leaves, besides the trouble they occasion to no purpose.

When the worms are just come out, keep them in a heat

not exceeding 15 degrees; and even then there is no occasion to cover them by putting on the heads of the boxes, as it is better for the worms to have abundance of free air. But if the weather should happen to prove cold, you must in that case put on the heads of the boxes at night, or cover them with a double napkin, taking care, however, not to let it touch the worms, for fear of hurting them, and take off the head of the box or napkin in the morning, when you give a feed to the worms, as early as you can, at four or five o'clock, but not later than the last. In that early state, the three different meals should be given to the worms at the distance of six hours from each other.

When the worms are coming out, they are not to be left scarce a moment, as they ought to be gathered from the boxes as fast as they make their appearance; and as this work goes on in the night as well as the day, it becomes a very hard task at that time. Monsieur Marteloy, the gentleman already mentioned, who always carefully attended to this particular himself, generally went to bed at nine o'clock in the evening, during this critical period, and got up again at midnight, which was quitting them as little as possible. But this great attention at this time is only requisite in large operations, for example, a pound of eggs, or any quantity above it.

Before proceeding to the further treatment of the worms newly hatched, it may be proper here to give some description of the stage and baskets necessary for the carrying on of this culture, as these ought to be in readiness some time before they are wanted.

The stage ought to be erected in a large room, with windows on each side of it, so as to be able to command a

thorough air when necessary, the walls and floor of which should be examined with the strictest attention, in order to fill up every little hole or crevice that can give access either to rats or mice, as both these animals eagerly devour the silk-worms whenever they can find an opportunity for that purpose.

In Languedoc and Quercy they make the stage six feet, but more frequently only four feet and a half broad, so that a person, by going first to the one side, and afterwards to the other, may be able with ease to reach over the whole breadth, both for the advantage of giving the leaves to the worms, and for clearing away their litter more easily. At every nine feet distance in the length of the stage, they fix a post in the floor, of a height sufficient to support the roof, and to those posts they nail a piece of wood across the stage, which piece of wood serves to support the baskets to be hereafter mentioned, which rest upon the cross bars of wood at the two ends; so that these bars ought to be four inches broad, which allows two inches for each basket to rest on, as the baskets join the one to the other at the cross bars. The stage being four feet and a half broad, takes two of these baskets to fill up its breadth. They make their stage to consist of as many shelves as the height will admit of, keeping at the distance of twenty inches from each other. The lowest table or shelf ought to be made six inches broader than the shelf immediately above it, that the lowest may project three inches on each side further than the one above it; and so on in proportion with all the other tables or shelves; the uses for making this difference of breadth in the different shelves shall be afterwards particularly explained.

It has been already observed that rats and mice are extremely destructive to the silk-worms when they can get

access to them; for which reason every precaution should be used to protect them against such dangerous visitors. For this purpose, therefore, the following one is generally attended to. They cover the foot of each of the posts of wood which support the stage with a piece of strong smooth paper, which is nailed to the wood with tacks, to the height of a foot above the floor; by which means, when these vermin attempt to mount, their feet slide upon the paper, so that they can get no hold. A hoop of glass of the same height, made of a size proper for the wood, might, perhaps, be found to answer the purpose better, though I was assured the paper had the full effect for which it was intended. The ant, or pismire, is also a most dangerous enemy to the silk worms; to guard them from which, the usual practice, where there is any danger from these insects, is to put a quantity of hot lime round the foot of each of the posts which support the stage, which fully answers for that purpose. Cats and poultry of all kinds are likewise destructive to the worms, and must therefore also be guarded against with care.

When the worms are young, they are put into wicker baskets, three feet long, and eighteen inches broad, the edges or sides of which are made from two to three inches high. They make them of that size in order to be the more portable.

When the worms come to be placed upon the stage, they are put into baskets four feet and a half long, and two feet three inches broad, and the sides or edges of them are from two to three inches high, and of the thickness of about three quarters of an inch. The bottoms of the baskets are made of plaited reeds, after being split in order to make them lie flat. They are bound all round with a slip of wood a little more than an inch broad, and about a quarter of an inch thick, to keep them together, which is nailed down, and

three cross bars of wood are nailed across the back of each basket to keep it firm.

With respect to the stages, all those I have seen appear to me to be rather too broad to admit of people working with that ease which is requisite. I should therefore incline to think, that in place of one broad stage in a room, of six feet, or even four feet and a half, which I have observed to be the narrowest in use in France, it would answer the purpose better to make two stages of three feet broad each, with a passage betwixt them of three feet broad, and a like passage of three feet upon each side of the room next the walls; together with another passage of the like dimensions at each end of the stages, by which means all your people could go about and work with ease, without incommoding each other, and, indeed, without being hampered in any shape whatever. Besides, the stages being only three feet broad, must be a great advantage at the time of mounting, (of which afterwards), because in that case the heat of the cabins in which the worms make their cocoons cannot be so great as must be the case when the stages are six or four feet and a half broad, as the fresh air must have much more easy access to pass through them; a circumstance of the highest importance, particularly at the time of mounting, as the weather, from the advance of the season, must then be greatly hotter than at any other preceding time during the whole course of the cultivation.

Both in Languedoc and Quercy I have seen baskets used nine feet in length, and four feet and a half broad, which exactly filled up one division of a shelf of the stage. But I could not by any means approve of baskets of that size, as they appeared to me to be extremely cumbersome and unwieldy; besides that, from their great length, and

the necessary slightness of the materials, they were very apt to ply and bend down in the middle, and for that reason were, in my opinion, to be avoided. In short, I regarded them as being greatly inferior to the smaller baskets above mentioned, as to real use and convenience.

It is proper to observe, that care should be taken to place the stage in such a position as not to allow the sun to dart directly upon the worms, as they are not able to bear the heat of it in this manner when it is great. It will even kill them, especially when they are young; and if it should not go that length in a colder climate than the south of France, it will, notwithstanding, have the effect to torment them, and render them very unquiet, and prevent them from eating with their usual appetite. If the sun darts upon them when they are large, you will see them fly from it as fast as they can, and seek for shelter in the shade, even at the expense of the want of their food. When young they are not able to get out of the way, and by that means are often killed by it, as above mentioned.

In place of the wicker baskets already described, I observed a very simple and good contrivance practised at Montauban, in Quercy. They take a barrel hoop, which they form into a circle, fixing it with packthread or twine, after which they bind across the bottom eight or nine rows of reeds, both ways, by which means the bottom is thrown into little squares, tying the reeds not only to the sides of the hoop, but fixing them also in all the different places where the reeds come in contact with one another. This forms a sort of basket, which is extremely light and handy; and besides, as the reeds stand at a good distance from each other, it gives much more air to

the worms, which is a great advantage. After making their baskets in this manner, they cover them with strong gray paper (the strongest paper is the best), and so place their worms upon them. This sort of basket I tried while I resided at Montauban, and found them lighter and more handy than those before described; however, it must be owned, that from their figure they do not pack so easily; or, in other words, take more room upon the shelves of the stage.

But to return to the treatment of the worms upon their being newly hatched: it is proper to observe, that too many leaves should not be given to them at one time, and that the leaves given should be spread very thin; because, if too thick put on, a great number of the worms, as they are then so small, will run the risk of being lost amongst the litter, from which they will not be able to disengage themselves; and you must be careful to cut the leaves small during the first ten or twelve days, where the number of your worms is such as to admit of your doing so: but if your quantity of worms is large, it would require too much work to cut the leaves for them, so that in such case you must give them entire.

When the worms are in their first age you need only clear away the litter once, because their ordure at that time dries as fast as they make it, being in small quantity. When the litter is to be taken away for the first time, you have only to turn the parcel upside down, and so pull off such a quantity of the litter as you find necessary, which is the most expeditious way of cleaning them at that time.

In giving the leaves to the young worms, you must make the leaves lie hollow upon them, to give air to the worms. When put on too flat and close, they prevent

that free circulation of the air which is at all times necessary for the health of these insects.

During the whole of the first age, the leaves of the young plants of the mulberry, in the seed bed and nursery, as being the tenderest, are greatly preferable to the leaves of older trees as food for the young worms; for which reason it becomes of importance to have always a succession of young plants coming on yearly in your nursery grounds.

When the silk worms enter upon their sickness, they abstain from that moment from all manner of food. As soon, therefore, as you observe some worms of a parcel begin to grow sick, in place of three give them only two meals a day; when more of them sicken, confine them to one meal only; and from the time you observe most of them sick you must give them no more food, till the whole parcel, or at least the far greatest part of them, get over their sickness, (by having cast off their old skin), that you may carry them all equally on; at least as nearly so as possible, which saves a vast deal of trouble in the management.

When the silk-worm gets over his first age or sickness he is of a grayish colour, and his little trunk, or point of his head, is of a jet black colour, by which he is then distinguished.

When he gets over his second sickness that little trunk is of a brown colour.

When he gets over his third sickness his head is remarkably large, which is the distinguishing mark at that time.

And when he gets over his fourth sickness he is of a brownish yellow, or deep buff colour.

You must not clear away the litter from the worms

while they are about changing their skin, or what is called their sickness; but as soon as they have got clear of their old skin then you are to remove all litter.

During the second age it is advisable still to continue to feed your worms with the leaves from the young plants in your nursery, as these are still preferable to those of older trees for the worms at this time.

You must now begin to be attentive to clear away the litter from time to time, so as to prevent all danger of its heating, which proves highly injurious to the worms. These insects are remarkably fond of cleanness, which besides helps to enliven them, and gives them a keen appetite for the first leaves which are given to them always after cleaning. The litter is taken away in the following manner. You scatter some fresh leaves upon one corner of the basket, to which the worms having attached themselves, which they will readily do, you then take up the worms by means of the leaves and stalks they cling to, leaving the litter underneath. Having thus taken up all the worms from that corner, and placed them above those adjoining to them, you then clear away the litter from that corner, and carefully sweep together, with a little broom of twigs or heath, all the refuse and excrement, which you must remove entirely before you replace the worms in their station; and in the same manner you must proceed with the rest, till you have thoroughly cleaned the whole basket.

During the third age make use of the leaves of such trees as have been planted out in the field, but reserve the leaves of your oldest trees for the fourth age, as these last leaves are reckoned the best for the worms when come to their maturity.

Be attentive to cleaning away the litter as before directed, which, during the third age, should be done at least four or five times; and take care to clear away, from time to time, all dead worms the moment you observe them; and to throw aside also regularly all such worms as appear to be diseased, to prevent them from infecting the rest, which will happen if this article is not pursued with the strictest attention. All the worms which you observe to grow of a yellow colour, and to have their skin shining, are strongly diseased, and must be immediately thrown away, for fear of infecting the sound ones. These diseased worms sometimes void a yellow liquid at the tail, and it often also bursts out at other places of their bodies. These must always be attentively removed the moment they are observed; but it becomes more essentially necessary before the worms enter into their third sickness, because at this time they become most dangerous, by voiding the yellow liquid above mentioned, which is poisonous to the worms, and exceedingly contagious; insomuch, that every worm that happens to touch this liquid is sure to be infected with the same distemper, which has hitherto been found to be incurable.

Here I must observe, that tobacco is an immediate and mortal poison to the silk-worm. If a few grains of snuff shall happen to fall upon one of these insects, it immediately shows great signs of agitation and distress, and in about a minute's time is thrown by it into convulsions, which end in death. Just before expiring it throws out a small glob of watery substance from its mouth; and if any other worm happens to touch this watery glob, that worm will also be immediately attacked with convulsions and die. Hence it appears to be necessary, that persons

who are employed in feeding the silk-worms should either give up entirely at that time the use of snuff, or should at least be extremely careful not to suffer the smallest grain of it to fall upon the silk-worms, as their death is the certain consequence of their touching it; besides the danger arising to the other worms, from their touching the little glob of watery substance emitted by the worm first infected before it expires. It is proper also it should be known, that oil of any kind is as immediate and dangerous a poison to the silk-worm as tobacco itself.

It has been remarked, that it is improper to change the worms during their sickness, because it may occasion the loss of some of them. But it is necessary to add, that if the litter at that time should prove to be in such quantity as evidently to run the risk of heating, before the worms can get quit of their old skins, which they generally do not accomplish in less time than two days and a half, that it is better to suffer the loss of a few worms, by removing the litter at that time, than to run the risk of losing the whole parcel, which undoubtedly would happen if the litter should be heated before the operation is over of their changing their skins. This article of keeping the worms clean will appear to be of high importance in the silk culture, when in is added, that it is commonly computed that the loss sustained yearly in France, by the death of the worms during the times of their four different sicknesses, by being smothered in the litter, by the great quantity of litter, leaves, and worms above them, and by the litter's happening to grow damp and to heat at these critical periods, is not less, upon an average, than between two and three millions of livres annually, which is equal almost to a tenth part of the

whole yearly produce of silk in France, which, as already mentioned, is computed at thirty millions of livres.

Here I must remark, that this is the time to assort your worms into different classes, and endeavour to have every class as nearly of a size as possible; that each class may be wholly ready to mount, and make their cocoons at the same time. This is also the time to push on those worms which appear to be a little behind, by not having had an equal easy access to the leaves with the rest, that you may render them equally ready to mount with the others. This is done by putting them into a basket, apart by themselves, and by giving them an additional meal each day more than what you give to the others, until you observe by your eye, that they appear to be equal in point of size with the rest.

Being now arrived at the fourth age, the time approaches when the worms will mount in order to form their cocoons; and the person, therefore, who pursues the culture of silk, must now begin to prepare for that important period. One of the first objects of his attention must be to provide himself with a sufficient quantity of small brush-wood, for making the cabins of the worms; and there is nothing more proper for this purpose than heath or broom, when either of these can be obtained; when neither heath or broom are to be had, any other kind of small brush-wood will answer, preferring always such as is bushy at the top, and whose twigs are of a sufficient strength to support the weight of the worms. But it is to be remembered that the slender brush-wood is the best, that you may be able to bend it which way you will. Strong brush-wood is not so pliable, and by that means not proper for the purpose.

Having provided your brush-wood, it may be proper to

prepare a parcel of baskets, for such of your worms as are soonest ready for mounting, in the manner practised at Montauban, in Quercy, which is done as follows: you take a round willow basket, which you dress with brush-wood, putting the wood round two-thirds of the basket, and leaving the other third open for putting in the worms, and to give an opportunity to clear away their litter. You then pull the ends of the wood together at the top, so as not to press too closely upon each other, and so tie them with a little twine, or pack-thread, to keep them in their place; after which you put a paper cap, pretty large, upon the top of the wood, it having been found that the worms are fond of making their cocoons under a cover of this kind, as it affords an opportunity of attaching some threads of silk to the paper, which enables them to fix their cocoons the more firmly in their place. I had some baskets dressed in the above manner, the brush-wood of which rose near four feet above the basket. This appeared to me to be an excellent contrivance, as it had the advantage of keeping the worms much more cool and airy, than when in the cabins on the stage. But this cannot be done with a large quantity of worms, because it occasions a good deal more expense; besides, that these baskets take up a great deal more room than the cabins on the stage.

In putting up the cabins on the stage, the two rows of brush-wood at the extremities of the stage are made much thicker than the others, especially for six or eight inches above the shelf, to prevent the worms from getting out at the ends, and falling over the stage. In putting up the other rows, you lay a little piece of wood, or a reed,

across the stage, for each row; and in putting up the brush-wood, you make the first turn to the right hand, and the second to the left; and so alternately, keeping the reed in the middle, which binds all fast. This article of the reed I first saw practised at Montauban, and seems an improvement to their manner of erecting their cabins in Languedoc, as it serves to make the cabins firm, and to keep the rows straight.

In dressing the stage with the brush-wood, it is advisable to cover the pillars which support it, and to cover likewise the top of the stage with brush-wood. In constructing the cabins, great care must be taken to put up the brush-wood in such a manner as to allow a passage for the worms betwixt the different branches, which, however, must not be too wide; and it is right to make a great number of the points of the brush-wood touch the shelf; because it affords the greater opportunity to the worms to mount. Many people at Montauban, I observed, put a number of roses, or other sweet smelling flowers, upon the pillars which support the stage, and in other parts of the room, with a view to sweeten the air. But the best apparent means for this purpose is to take care to keep up a free circulation of fresh air in the room, by keeping open all the windows, and the doors also, if you find that to be necessary.

In forming the arches of the little cabins with the brush-wood, there is always a little opening at the top of each pillar, occasioned by the curve or top of the circle. Take care to make this opening pretty wide, because it has been observed, that the worms make choice of that opening, by preference, to fix themselves in making of their cocoons.

In order to make this opening of the width it ought to be, the brush-wood should not be altogether straight, but rather crooked or bending. These openings are not only evidently the choice of the worms; but another advantage also arises from them, namely, that your cabins by this means contain a greater number of worms than it is possible for them to do when these openings are too small; and consequently fewer cabins will answer your purpose. When the brush-wood is quite straight, it must necessarily occasion these openings to be made. The brush-wood ought to be quite stripped of its leaves, and perfectly dry.

If, in forming the cabins, you place the brush-wood quite upright, the worms, when mounting, run a great risk of tumbling down, of which I have seen several examples; and those worms which tumble down are for the most part destroyed by the fall. In order to avoid this inconvenience, you must make the brush-wood which forms the sides of the arch slope a little, by which means you secure much firmer footing to the worms in mounting. Besides, when you form the cabins, you must be at pains to cut off all the very small slender shoots, which, when left to themselves, and not properly bound in with one another, have not strength sufficient to carry the weight of one worm, far less of several; and which, if left, must for that reason always occasion the loss of a good many worms by their tumbling down, as above mentioned.

In describing the stage, it was said to be proper to make the lowest shelf six inches broader than the one above it, that the lowest may project three inches on each side further than the one immediately over it; and to make the same difference of breadth in all the other shelves progressively

as you go up to the top of the stage, which three inches of breadth in the different shelves is intended to receive the worms which may happen to fall from the shelf above. And therefore these different projections must be covered with brush-wood, when once your cabins are well furnished with worms, as this will help to break the fall of such worms as may happen to tumble down. And for the same reason it is advisable, when once your cabins are well furnished with worms, to put a little brush-wood in the bottom, and at the entrance of each cabin, as it will be of service to such worms as fall from the brush-wood above, and afford them a proper convenience for making their cocoons in case they should be so stunned with the fall as to disable them from mounting again on the branches.

But to return to the treatment of the worms during the fourth age: as soon as you find several of your worms have got over their fourth sickness, you must pick them out and put them by themselves, that is, all those that get over that disease for the first two days may be put into one parcel; those of the next two days into another parcel, and so on with the rest, that each separate parcel may be carried on as equally as possible.

Here I must observe, that the practice in France is to give none of the tender leaves, from this time forward, to the worms, but to let the whole of their food consist of the leaves of the oldest trees they have, which, they think, has the effect to give more consistence and strength to the silk produced by them; and it is proper to add, that from getting over the fourth disease, till within four or five days of their mounting, they are in use to give four meals a day to their worms.

The most attentive care must also be given to clear away the litter regularly every day, and, if it can be got done, it would be advisable to clear away the litter twice in the twenty-four hours, especially during the four or five days immediately before mounting. If this cannot be done, as it is often found to be difficult to get it accomplished when the quantity of worms is large, you must, however, constantly make it a rule to clear away the litter regularly in such a manner as to prevent it at any time from increasing so much in quantity as to make it run the smallest risk of growing damp, and heating, which never fails to destroy the worms.

Many people during the four or five days which precede mounting, which the French call the *grande fraize*, are in the custom of giving from four to five meals a day to the worms, giving a large quantity of leaves at each meal. But it seems much more advisable to give them fewer leaves at a time, and to repeat their meals oftener, even to the number of eight or nine times in the twenty-four hours, according as you find them in appetite; by which means the leaves are more quickly and thoroughly eat up, without occasioning so great an increase of the litter. But what is still of more consequence, the fresh leaves so often repeated never fail to give a fresh edge to their appetite; so that in fact, in the space of twenty-four hours, the worms actually eat up a much larger quantity of leaves than they could have done by following the other practice of four or five meals a day, as none of the fresh leaves are spoiled by their treading upon them. This practice of course hastens the worms to their full maturity, and upon the whole saves a considerable quantity of leaves, because

few or none of them are lost amongst the litter. Besides, that the operation is by this means sooner brought to a conclusion, and the worms always kept in high health and appetite by it. Upon these occasions let it be a fixed rule to feed them at night, immediately before going to bed, and as early as you possibly can in the morning.

There is another particular to which it is proper to pay attention, and that is, that the moment a basket of worms is cleared from the litter, the litter should be instantly carried out of the room, and along with it all the dead worms you can find, in order to prevent, as far as you can, any bad smell from taking place in the room, which is always hurtful to the worms, nothing conducing more to their health than cleanness, and preserving always good air in the room.

During the four or five days which precede the mounting the worms eat with the most voracious appetite, and in that period consume an incredible quantity of leaves, so that the supplying them with fresh leaves, and the clearing away of the litter, become at this time a most laborious, incessant, and fatiguing work for those who attend them.

You will know when the worms are ripe, by observing them with attention when you give them fresh leaves. Those that are ripe, instead of eating, avoid the fresh leaves, and run over them as fast as they can; and you will observe them wandering about on the sides or rim of the basket. You will also know it by looking at them on the side opposite to the light, as you will then find them to be transparent, like a new laid egg, and of the colour of the silk, which is also much the same with that of a new

laid egg. When they are nearly ripe their bellies begin to grow transparent first of all, but they are never thoroughly ripe till their heads are transparent also.

You must not be too hasty in putting up the brush-wood on the baskets on the stage for the worms to mount. This ought not to be done till you observe a good many of your worms offering to mount, because the brush-wood keeps the worms too close and warm, and exposes them to the danger of that disorder which the French call the *touff*, which is very fatal to the worms, and which does not seize them till they are just ready to mount. When they are perfectly full, and ready to mount, they are rendered feeble by too great heat, and the silk fairly choaks them, so that a great deal of fresh air becomes more particularly necessary for them at this time than at any other. For this reason it is even thought to be advisable not to put up your brush-wood until you have seen a cocoon fairly made upon the stage. At any rate you can have some of your large baskets (of which you should have an ample provision) ready dressed with brush-wood, into which you can from time to time, as you observe them, put such of your worms as you find are fully ripe for mounting. Besides, when you see a whole parcel ready to mount, you have only to take the basket which contains them out of its place, and put up one of those which is already dressed with the brush-wood, by which means you can put your worms directly into the little cabins prepared for them, which will render your work much easier than it would be otherways, and make it less hurrying. The basket thus emptied of the worms should be instantly dressed with brush-wood, to be in readiness

for the next parcel that shall be ready for mounting. Not a minute is to be lost when the worms are fully ripe, so that a number of these additional prepared baskets are of the utmost consequence at this time.

In preparing the little cabins for the worms you must make choice of such small brush-wood as is bushy at the tops, as already mentioned; and in arranging them you must intermix the tops of them with each other, which will render them thicker in the heads, but taking care always to leave little openings betwixt the twigs, so as the passage for the worms may not be stopped, which is attended with this advantage, that it affords a great many little places proper for the worms to form their cocoons in. When the heads of the brush-wood are too thin, the worms find themselves at a loss to fix themselves, and spend a great deal of their strength in ranging from branch to branch, to find a proper place for them. In placing your brush-wood, you must order it so that the bottom parts of it shall stand as close to one another as possible, that the worms in groping about may everywhere find bushes to cling to. In using many kinds of brush-wood, where the tops are very bushy, this will of course put the bottoms at a distance from each other. But these vacancies you must fill up with little twigs, for the purpose above mentioned; to wit, that the worms may everywhere find branches to crawl on.

When you put up the brush-wood betwixt two baskets, that is, when there is one basket placed over the head of another, as is always the case on the stage, you have only to cut the branches of an equal length with one another, but about eight or nine inches longer than the distance

betwixt the two baskets; then resting the bottom part upon the undermost, you bend the top in a curve downwards, either entirely to one side or to both, as the bushyness of the brush-wood will allow of it. The ranges are made across the breadth of the basket, at the distance of about eighteen or twenty inches from each other, so that you may easily put in your hand from one side to the other, to enable you to clean the intervals from time to time from the litter, as you shall find it necessary, which ought to be done at least once in twenty-four hours after the bushes are put up, and even twice if you can find time for it. The bushes are placed in such manner as to form with their heads little arches betwixt each row of the branches. By placing the bushes as above they stand erect and firm, because they press equally upon the undermost as well as on the upper basket.

When the worms are mounted on the brush-wood, care must be taken not to suffer anybody to disturb them, by handling or touching the brush-wood, because when they begin to work, their first operation is to fix so many threads of silk to different parts of the branches, which threads are to serve to support and hold up their cocoons in their proper poise. If any one of these silk threads is broke by handling the branches, the worm finds, when he comes to work in the cocoon, that by the loss of that thread the cocoon has lost its poise, by which means, as it does not remain steady, he cannot work with advantage, so as to finish his cocoon properly. Disappointed by this means of continuing his work, he pierces the cocoon, quits it altogether, and throws out his silk at random wherever he goes, by which means his silk is wholly lost, as is the worm also, as he finds no place to lodge in with

propriety, in order to prepare for his last change of state, when he is to come out a butterfly.

Some of the threads of silk, which it has been already said the worm attaches to the different branches, upon his first beginning to work, are likewise sometimes broke by another worm working in his neighbourhood, which is attended with the fatal consequences above mentioned, though this last is an accident which happens but very seldom.

Such of your worms as you find loiter below, without mounting, notwithstanding they are ripe, you must be careful from time to time to place upon the brush-wood, which is ranged at the two ends and along the sides of the stage. There are always some of the worms which are lazy, or have not strength enough to mount on the branches, which however are strong enough to make good cocoons when they are placed where they can make them, without the fatigue of mounting the brush-wood. Those which are so unlucky as to tumble from the brush-wood should also be placed with the other weak worms, because the fall generally diminishes their strength greatly; and those which you then place upon the brush-wood should be covered over with a piece of paper, to which they attach the threads of silk to keep their cocoons steady. You may also place some of the weak worms in papers, made up in the form of a cone or sugar-loaf, in which they will make their cocoons extremely well.

Great attention must also be paid to visit carefully from time to time all the different cabins, in order to remove immediately all diseased and dead worms; because the last, if left, will presently stink, and occasion a bad smell in the room, which would particularly annoy the worms

which are at work in making their cocoons in the same cabin; and the diseased ones would infect the others which are sound.

When it is observed that a great proportion of the worms of the same basket are ripe, and that they are wandering about in quest of the brush-wood, the common practice has been to place the whole worms of that basket at once into the cabins for mounting. But this practice is attended with no small degree of inconvenience and danger, because it is impossible to manage your worms in such a manner that the contents of a whole basket shall all of them be ready to mount at the same instant. The consequence then is, that those which are ripe mount directly, and those which are not ripe remain in the cabins, and must have food given to them till such time as they are ready to mount in their turns, during which time the litter must be changed frequently to prevent corruption: but what is worst of all, the worms which are mounted on the brush-wood, before beginning to shut themselves up entirely in their cocoons, discharge a quantity of liquid matter, which falls upon the worms below in the cabins, and wets and dirties them prodigiously; and that glutinous liquor drying and hardening upon their skins, prevents their perspiration, and deprives them of that pliancy and agility which are so requisite to enable them to mount, as well as to make their cocoons. The consequence often is, that the worms thus wet with that glutinous liquor contract diseases and die, at the very instant they are ready to mount; and as these diseases are too often contagious, by the worms bursting, the contagion is spread over the rest, which become also infected, and so

the whole which remained in the cabins are often entirely lost.

Some few people, who are more attentive, and are sensible of the dangerous consequences of the above method, follow a different practice. They have the patience to pick out the worms, one by one, from time to time, as they observe them to be ripe, which they then place in the cabins, and which never fail to mount immediately, when they are properly chosen; that is, when the person who gathers them is a proper judge of their real point of maturity, which discovers itself by their bodies, but more particularly their heads being perfectly transparent, as before mentioned. The other worms, which are not ripe, they leave in the basket, and give them their food in the usual manner, till they become ripe in their turns, when they are constantly gathered up from time to time, and put into the cabins as they come to maturity. By this means you can change them with ease, and they are safe against being wet with that glutinous liquor above mentioned, which from repeated experience has been found to have such pernicious and destructive consequences. One may alledge that this last practice occasions an additional trouble, but the answer is obvious, that by this method a great number of worms are preserved, which are utterly lost by following the other practice of putting the worms of a whole basket at once into the cabins; and consequently the quantity of silk produced is considerably increased, which does more than repay that additional trouble tenfold.

In putting the ripe worms into the cabins, take care to place them first of all in the middle of the cabins, that

the middle may be well furnished with worms before you place any at the sides. Should you begin first with the sides, or outward ends of the cabins, you will find it extremely difficult to supply the middle of the cabins with worms, without disturbing and even destroying some of those which are mounting on the sides, in reaching in with your hand towards the middle.

I shall here take an opportunity of mentioning, that during the two first ages of the worms my practice always was, agreeable to Mons. Marteloy's system, to keep the windows of the room shut; but when once the second age was over I inured them by degrees to the fresh air, by opening the windows at first for a couple of hours in the middle of the day, and increasing the time of the open windows from day to day, till at last I kept them always open day and night, particularly from the time of their getting over their fourth malady, till they completed their cocoons, unless the weather happened to prove remarkably cold and wet. But though this practice succeeded perfectly well in the south of France, I do not by any means take it upon me to say that it is advisable so pursue the same method in Britain, as the difference of climate is great. On the contrary, I should incline to think, that in England the windows should always be kept shut during the night; but when once the second age is over, that it would be proper to habituate the worm gradually to the fresh air during the day, more particularly after their getting over their fourth malady, when it is of the greatest consequence to them: but even then, in case of cold wet weather, I should think it advisable to shut the windows ocasionally during the day. In short, in this ar-

tiele, a man's conduct must be regulated by prudence and good sense, in which his experience will greatly assist him.

Though the following article was regularly entered in my notes, it somehow escaped me at the time I drew out from them the foregoing observations, which makes me take the liberty of adding it here, though out of its place, as it appears to me to merit attention.

Upon the article of hatching the worms, it has been recommended to save the production of the first four days, as I observed this to be the general practice in France; but I must mention, that having met with a French gentleman at Montauban, who I understood had dedicated much of his attention to the culture of silk, and in which I was assured he had been particularly successful, I took the liberty, with a view to gain information, to request of him to favour me with an account of his method of management, with which he politely complied. By the account I received from him, I found that the material difference betwixt this gentleman's management and the general practice consisted in the following particulars. He told me, that having long observed that the worms which were first hatched turned out always to be more healthy and vigorous than those which were later in coming out, he had for this reason adopted the following plan, which he had then followed for several years, and to which, in a great measure, he attributed his success.

If his intention was to raise a quantity of worms equal to two ounces of eggs, his practice was to put two ounces and a half of eggs to germinate, and to save no more than the production of the three first days, throwing away all

the rest. He likewise made it a rule, upon their passing through their different maladies, to take only the forward worms, throwing away regularly all those which remain long in getting over their maladies, and he gave the following reason for his continuing to follow this plan; namely, that from many years experience, he said he had found, that those worms which are hatched after the third day always turn out to be weakly, and are tedious in all their operations. For the same reason he rejected all those worms which linger in getting over their maladies, which he said was owing to their weakness, or to their being infected in some measure with some disease, which generally carried them off before they could make their cocoons; or if they did get the length to make their cocoons, these last he maintained were so light, that they were not equal in value to the expense of the leaves which these worms will eat during their *grande fraize*. At getting over their different maladies, he saved only such as came away the first two days, throwing away all that were not ready at the close of the second day. From what observations I had myself made upon the silk-worm, I thought this gentleman had a great deal of reason upon his side; but as, in every thing in relation to this culture, I uniformly made it a rule to satisfy my mind fully by experiment, I firmly resolved to submit his plan to that test. I was, however, disappointed in fulfilling my intention in that respect, by my having been obliged to return to Britain upon business before the next season of the silk culture came round. At the same time, as I still continue to regard this article as a matter of great importance to that culture, I would humbly advise, that it should be fully canvassed by experiment.

III. The cocoons should be allowed to remain upon the brush-wood for six or seven days after the last of the worms of that particular parcel are mounted.

After the cocoons are taken down, they should be assorted according to their colours, setting apart all the weak cocoons, and such as are double. Those of each colour, which have a shine upon their surface, and thence called sattiny, should also be put by themselves, as they form the second sort of silk. The double cocoons form the coarsest silk of the whole.

All the floss, or loose silk which is round the outside of the cocoons, must be carefully taken off, because the better the cocoons are cleared from that outer silk the better they play in the bason, and of course the better the silk will wind off.

In clearing off the floss silk from the cocoons, when taken down from the branches, it is customary to make choice of those which are judged to be the best for seed, which are put aside by themselves, and afterwards from the whole of those to pick out in pairs such as are judged best for the purpose; taking care in this last choice to pick out an equal number of males and females, as far as one can judge of the different sexes by the cocoons. In doing this care must be taken to keep the cocoons of the same days mounting always separate by themselves, that the butterflies may pierce the cocoons at the same time. If the good cocoons taken from the whole are all first mixed together, and from this general heap the cocoons are afterwards picked out in pairs for breeding, the consequence will be, that there will be set aside the cocoons of worms that have mounted the brush-wood upon different days, which of course will have the effect, that the butterflies will pierce the cocoons unequally; that

is, not on the same day, but at times distant from each other; so that there will not be an equal number of males and females produced at the same time, which must occasion the loss of a great many of the butterflies, and consequently the quantity of eggs or seed will fall short of what was intended, which shows the necessity of precision in keeping the cocoons of each day apart.

When you happen to have more females than males, you must employ the males of the preceding day a second time, that you may not lose your supernumerary females. But this is only to be done upon an urgent case of this kind, because it is greatly preferable to cause the males to serve only once, if you can calculate so as to have always an equal number of both sexes for copulation.

The double cocoons are to be distinguished by being much thicker than the others, generally broad, and not quite round.

In taking the cocoons off the brush-wood pick them off carefully, especially if there are any dead worms amongst them, which presently corrupt; because such of the cocoons as touch these dead worms are spoiled by them, as they contract by that touch glewiness from the dead worms, which hinders the silk from winding off properly from the cocoon. The best manner to know the good from the bad cocoons, is to press them at the two ends with your fingers. If they resist well that pressure, and appear hard and firm betwixt your fingers, the cocoons are certainly good.

Though they appear firm upon pressing their sides with your fingers, they may still not be entirely good; the pressure at the two ends being of all others the best manner of knowing the good ones.

After the cocoons are taken down from the brush-wood,

such of them as are intended for seed must, with the utmost care, be cleaned from all the floss or loose silk which is about them, which, if allowed to remain, would greatly hinder the butterfly from getting out of his cell; after which, with a needle and thread, you must thread the cocoons by the middle, like a string of beads. But in doing this you must take care not to hurt the insect in the cocoon with the needle. You are only to pierce just as much of the skin of the cocoon as is sufficient to attach it to the thread, and this is done at the middle of the cocoon, to leave the two ends of it free, as you cannot be certain at which of the ends the insect will pierce the cocoon. This being done, you hang up the cocoons against the wall of the room by a nail, until such time as the butterflies come out.

At putting the cocoons upon the thread, in order to prepare them for breeding, be at the pains to place a male and female cocoon alternately upon the thread, that they may be near each other for copulation, when they come to pierce the cocoons; and when the butterflies come out you place them upon a piece of clean woollen cloth, that is perfectly smooth, having no nap or pile upon it, which may be hung upon the back of a chair.

The male is easily to be distinguished from the female by his body being more slender, and by fluttering his wings oftener, and with a great deal more force than the female. When they have been about ten hours in copulation, the male is to be gently removed, as the female is supposed by that time to be sufficiently impregnated. The female will then proceed to lay her eggs upon the cloth, to which they will closely adhere, and upon which you let the eggs remain till about a month before the usual time for hatching,

when they are to be taken from the cloth, which is generally done by means of a thin piece of copper coin, which in France passes for a penny (*un sol marque*), and which is found perfectly to answer the purpose. The cloth upon which the eggs are laid is folded up lightly and kept till the proper season in a drawer or closet in a dry room, but not too hot. Every female butterfly is calculated to produce from three to four hundred eggs. The reason for recommending the eggs to be taken off the cloth about a month before the usual time of hatching, is this, that it can then be done without the smallest injury to the eggs, which at that time are pefectly hard and firm; but if delayed till the time of hatching, the case becomes greatly altered, because the eggs gradually soften by the approach of the spring, so that they cannot then be taken from the cloth without the evident risk of destroying a great part of them.

Was it possible to wind off the silk from the other cocoons before the insect naturally pierces them, that is the best time for doing it, because the silk at that time winds off with much greater ease than afterwards. But as that is found to be impossible, two methods have been pursued to destroy the insect in the cocoon, that they may wind off the silk at leisure, and with full convenience. The first method which was followed in France for that purpose, was to destroy them by placing the cocoons in baskets in a baker's oven; but if the oven happened to be a little hotter than was proper, the silk was by that means scorched, and often very much hurt by it. They therefore tried to kill the insect by the steam of boiling water, which could not at all hurt the silk, and they succeeded; so that the placing them in the oven is now wholly laid aside. The killing of

the insect by the steam of boiling water is performed in the following manner.

They build a little furnace of brick, of a kind of oval form; the ground part of which is for holding the wood or charcoal which they use upon this occasion; and to make the fire burn properly, they have a little iron grate in the furnace, upon which they place the wood or charcoal; and over that, at a little distance they place a little copper cauldron, which they fill with water, and make it boil by means of the fire underneath. Above this cauldron they have another iron grate, upon which they place the cocoons, in a little open basket composed of twigs, which is made pretty open between the twigs, to let the steam and heat of the boiling water have the easier access to the cocoons. To this cauldron and the grate above it for holding the basket with the cocoons, you have access by a little door which opens above the entrance for the fire. The furnace is arched over the top with bricks, that when the door above-mentioned is shut, the steam may be retained within, which, in the space of eight minutes, is found effectually to kill the insects within the cocoons. The basket is then taken out and put aside, to let the cocoons dry, as upon coming out of the furnace, they will be all of them wet with the steam, and they then place another basket in the furnace with more cocoons, taking care so to keep up the fire, as to have the water in the cauldron always boiling. Charcoal is preferable to wood for fuel upon this occasion, because it has no smoke. The smoke of wood spoils the colour of the silk, and takes away from its lustre. The smoke of pit coal would still be worse.

Here it is proper to add, that after the insects have been

killed by the steam, as above-mentioned; care must be taken to stir about and move the cocoons regularly, at least once a day. If this is neglected, the insects will corrupt, and breed worms in the cocoons, which will destroy the silk. After the cocoons are taken out of the furnace, and dried a little, as before directed, they should be wrapt up in a good thick woollen blanket, to keep in all the hot steam, and to prevent all access to the exterior air. This is done with a view to stifle any of the insects which may happen to be yet alive; and which, if immediately exposed too much to the open air, might revive and recover their strength. They are left covered up in that manner with the blanket for five or six hours together; after which they are to be taken out of the basket, and spread out upon a table; and are afterwards to be stirred, and moved about regularly every day, as directed above. And you then assort the cocoons according to their different colours, of which they have three sorts in France, namely, the white, the yellow, and those of a greenish colour.

When the insects are once killed, the sooner you wind off the silk from the cocoons the better; because it can then be done more easily than after they have been kept for some time; upon which account they always wind off the silk as fast as they possibly can; and it is done in the following manner: They build a little copper cauldron into a small furnace of brick, with a fire-place under it, as in the other furnace already described, exactly in the same manner as we do in Britain, at the sides of our rivers, for the washing of linen at our bleach-fields; at the end of which they have a large reel, which turns round with the hand, and by a foot-board, and two or three little pieces of iron at proper distances, with eyes to them, by which to

conduct the threads to the reel. The cauldron above-mentioned they fill with water, and keep it always boiling with a fire of wood or charcoal; the last, however, being preferable, on account of its being free from smoke. They then put from twenty to thirty cocoons at once into the boiling water, and, with a small brush of little twigs, (of heath for example) they keep stirring the cocoons about. The heat of the boiling water dissolves the gum that is naturally about the silk, upon which, as the cocoons are continually touched and tossed from side to side amongst the water by the little brush, the ends of the silk attach themselves to the brush. When the woman who manages the brush perceives that she has got hold of the ends of the silk by it, she takes hold of the silk thread with her hand, puts aside the brush, and pulls the silk towards her, which disengages itself with ease from the cocoon; and this she continues to do till she has got away all the floss or outside silk of the cocoons. When she observes she is come to the fine silk, she breaks off and separates the coarse from it, which coarse silk she puts aside. She then applies her brush again till she has got hold of the end of the fine silk, all of which she sets apart, every fine thread by itself, by fixing it to a piece of wood kept near to the furnace for that purpose, till she has arranged the whole, or at least the greatest part in this manner, which by that means are in readiness to be thrown in, to form the thread of silk which is to be wound off.

This done, she puts together the threads of as many of the cocoons as she inclines, according as she wants to make the thread fine or coarse. These she joins together, and after having put the silk through one of the eyes of two of the pieces of iron which are placed for conducting the

thread to the reel, she fixes the silk thread to the reel; upon which another woman, who attends to manage the reel, begins to turn it about with her hand, and keeps it in motion by applying her foot to the foot-board, and by this means winds off the silk from the cocoons, which is done with great swiftness.

As soon as one or more of the cocoons are exhausted, the woman who manages the cocoons in the cauldron or bason, supplies their places from time to time with others, taking care while these are winding off to prepare others for keeping up a continual supply; and taking care also to observe, that the silk winds off regularly from all the cocoons she puts in play together.

As she is obliged to have her fingers almost every other instant amongst the boiling water, in order to manage the cocoons properly, she has a bason of cold water at hand, into which she dips her fingers alternately with the other, to prevent scalding them. But in spite of her best care, a woman who works any time at this management finds her fingers at last so affected by the influence of the boiling water, that they are for some time in such a state she has scarce any feeling with them; but this afterwards goes off gradually.

Here it must be observed, that in forming the brush before mentioned, great care must be taken to have the points of it exceedingly small; because if the points are large and coarse, the silk will not take up fine from the cocoons, but will rise off thick and clotty, which will prevent its winding off properly upon the reel.

The winding off the silk is always performed in the open air, generally in some garden, to prevent any accident from the fire, and more particularly to prevent any bad effects

from the bad smell of the dead worms, which stink prodigiously. For these reasons, this work is not suffered to be performed in any large town, but must always be done without the walls. When the day's work is over, they make a fire of brush-wood, into which they throw all the dead insects, which are taken from the bottoms of the cocoons, opened with a pair of scissars for that purpose, and burn them together, in order to prevent any bad consequences from their stench and smell. This is done every night regularly, before the work people retire for the evening. As the manufacturers of the silk, and merchants who want to sell it, buy up large quantities of the cocoons, some of these people will have from ten to twenty of these little furnaces going at a time in the same garden, and even sometimes more.

As the whole of the silk cannot be entirely got off by the reel, what remains upon the dead insect is put aside, with the coarse part of the silk, which is taken from the cocoons in the beginning, till you meet with the fine thread which is proper for the reel.

The dimensions of the stove and bason made use of at Montauban, and described above, are as follows:

Height of the stove from the ground, twenty-two inches and one-fourth part of an inch.

Length of the stove, twenty-nine inches and a half.

Breadth of the stove, twenty-four inches.

Height of the iron bars for supporting the charcoal from the ground, for holding the fire, twelve inches and one-fourth part of an inch.

Width of the door, or opening, at the bottom of the stove, for taking out the ashes by, and for giving air to the fire, nine inches and one-fourth part of an inch.

Width of the door, or opening, at which you put in the charcoal, for supporting the fire, seven inches and a half.

Length of the oval copper bason, which is built in on the top of the stove, for containing the hot water, in which the cocoons are put when they wind off the silk, twenty inches and three-quarters of an inch.

Width of that bason, sixteen inches and a half.

Depth of the bason, three inches and three quarters of an inch.

Breadth of the rim of the bason, one inch and one quarter of an inch.

Here I might have given the dimensions of the Italian reel for winding off the silk, being the same which is used for that purpose in France; but that becomes unnecessary, as I find that the Society are already in the possession of a model of it. I shall therefore proceed to mention sundry particulars which relate to the winding off the silk.

Spring water or rain water, as being soft, is the only proper water to be used in the bason. Draw-well water is altogether improper for this purpose, because it is hard, and does not properly dissolve the gum which is naturally upon the silk.

The water in the bason must be wholly changed twice a day; it is filled in the morning before setting to work, and the second time immediately before the people go to dinner, as it requires sometime to make it boil.

When you first put the cocoons into the hot water, if the silk rises thick upon the brush, it is a proof that the water is too hot. If you cannot catch the threads of silk with the brush, it is a sign that the water is too cold.

When the cocoons are in play, if they rise often to the little iron conductors, it is a proof that the water is too hot.

If the cocoons will not follow the thread, it is a sign that the water is too cold. By attending to these observations, you can easily manage so as to give that degree of heat to the water that is proper for the cocoons.

If there should happen to be any sand amongst the water in the bason, the heat makes it rise to the surface, where it fixes itself upon the cocoons. This is easily known, because where there is any sand upon the cocoons, it makes the thread break, as if cut with a knife. For this reason the utmost care must be taken to guard against it, by cleaning the bason with the greatest attention. The fear of having sand is one of the reasons for changing the water of the bason at mid-day, and even oftener, if found to be necessary. When they find that there is a little sand, and that they wish to avoid changing the water, on account of the loss of time which that operation requires, as the water must be boiling before you can go on with the winding; I say, in this last case, they cover the face of the brush all over with a parcel of the coarse silk, which is laid aside, and you then put the face of the brush into the water, making it reach the bottom of the bason, along which you draw the brush gently, to catch hold of the sand with the coarse silk, to which it will immediately cling when it comes in contact with it. You then drag the brush gently up the side of the bason, and thus bring out the sand along with it. This operation, several times repeated, cleans your bason of the sand, without your being put to the trouble and loss of time in changing the water.

Take care to keep up your fire under the bason in such a manner, as to secure having the water always of the same degree of heat, and to throw in your addition of cold

water by little and little at a time, so as it may make as little odds as possible in the degree of heat. When you throw in too much cold water at a time, so as to alter the requisite degree of heat, the silk of the cocoons which are in the bason at that time, loses its colour, and grows perfectly pale; which silk, so rendered pale, it is said will not take any dye properly, which by that means diminishes the value of your silk.

In beating the cocoons in the bason with the brush, you must carry your hand as light as possible, so as just to touch the cocoons slightly. If you beat too hard, the threads of silk, in place of coming off singly, cling together in lumps, which, as it prevents its winding off, occasions the loss of the silk, as it will then only answer as waste silk.

When you take the fine threads to throw them to that which is winding off, they must not overlap your finger more than an inch; if too long, they will not join well, but hang down and occasion a lump, which causes the thread to break, as it is then too large to pass through the eye of the little iron conductor.

In winding off the silk you must be attentive to keep the thread wet, to make it slip along the more easily towards the reel. And when the wheel has remained any time idle, you must also wet all the thread betwixt the bason and two pieces of iron, which makes the thread run the more easily.

Be attentive also from time to time to wet with water the cord, and the little wooden wheel, which moves the wooden regulator, in order to make it act properly. If this is neglected, the cord, by being dry, will not turn the regulator as it ought, by which means the silk will be

placed unequally upon the reel, which may have this farther disadvantage, to cause the silk threads upon the reel to cling and stick to each other, by having been brought into contact before the first threads have had time to dry. For that wooden regulator is calculated to place the threads in such a manner upon the wheel, as to make them touch one another only obliquely, and in as few places as possible at first, that the silk as it comes from the cocoons may have the time requisite to dry, before it comes to be fully in contact with that which follows. When the silk threads cling together, by being too soon brought into contact, the silk is rendered good for nothing.

The cocoons called satiny, from their resemblance to satin, require only that the water should be moderately hot in the bason. The same degree of heat that is necessary for the fine cocoons, would entirely spoil the others by making the silk come off thick, and what they call *bourry*. You find out the degree of heat necessary for these, by examining with care in what manner the silk comes off from the first quantity of cocoons you put into the bason; and if you find it comes off thick, you must add cold water by degrees, till you find the just proportion for them. They must not be allowed to remain long in the hot water, and there should only be a few of these cocoons put into the water at a time. If these circumstances are not attended to, the silk comes off thick, as already mentioned, which, in winding, makes the thread break at every moment, and not only greatly diminishes the quantity of your silk upon the reel, but also considerably hurts its quality, by rendering it coarser.

When once the reel has the quantity of silk upon it you judge to be sufficient, the produce of about three

pounds of cocoons, for example, you take it off, and put another reel in its place, that the work may not be interrupted. The silk ought to remain for six or eight hours, or even more, if you can allow it with your convenience, as it ought to be perfectly dry before it is taken from the reel.

When the cocoons which were first put into the bason are nearly finished, you must cause the wheel to be stopped; at which time, with a ladle full of holes, like a drainer, you take out the cocoons which were in play, each parcel on the opposite side. They are put into plates kept at the side of the furnace for that purpose; and are taken out of the bason for the following two reasons: first, that they may not be mixed with the new cocoons, which are put into the bason to be prepared for winding, as already mentioned; secondly, because if these cocoons, which are already in part wound off, were left in the boiling water till the new ones are prepared, it would have the effect to prevent the silk from winding off from the cocoons with that dispatch and propriety which is necessary in that operation.

As soon as you observe that the silk is wound off from the cocoon, you must take out the bottom of the cocoon containing the insect from the bason and throw it aside; because, if left in the bason, it will spoil the water, and consequently destroy the colour of the silk.

You must be at pains to keep an equal number of cocoons working at each end of the bason, in order to keep the thread of silk of an equal size. When you have fewer on one side than the other, the silk becomes smaller at that side, of course, which also has the constant effect to break the thread. In order to keep the thread at both sides of an equal size, you must throw in the cocoons, one

by one, and never more than two at a time. If you throw in many together, for example, four or five at once, it throws the weight to that side, when the thread immediately breaks, because by that means the equilibrium is lost.

In putting the silk thread round the two little pieces of wire, for conducting it to the reel, fixed to the little wooden wheel, you must turn the thread round to the right-hand for the bit of wire placed on the right; and turn it round to the left-hand, for the piece of wire placed on the left. In mentioning the right and left, I mean the right and left-hand of the woman as she sits managing the cocoons in the bason.

The quicker the motion of the wheel is, the better the silk winds off, and the better the ends join to the thread, which is, indeed, one of the great reasons that makes it wind off well. One might be apt to imagine that the rapidity of the motion might overstrain and break the thread, but from constant experience it has been found that the thread never once breaks from the rapidity of the motion; but, on the contrary, that the quicker the motion is the more advantageous it is for winding the silk.

When you have put the quantity of silk upon the reel which you think proper, you then pick and clean off all the loose silk with your fingers; after which you take a little handful of the coarse silk, and after washing it to make it thoroughly clean, and squeezing it, you must dip it in some cold clean water, with which, in the flat of your hand, you rub over the silk upon the reel, a great many different times, all round the reel; stroking up also the silk with the flat or palm of your hand. After which you then pour some clear cold water also upon the silk; and

you then turn round the reel with all the velocity in your power, for about eight or ten minutes, in order to shake off all the water effectually; which done, you take off the reel, and put it in some airy place to dry; but you must not expose it to the sun, which would quite eat away and spoil the colour. This is done to clean the silk effectually, and to give it a gloss.

In preparing the double cocoons for winding off, they put more of them into the bason at once than of the finest kind. But before putting them into the bason, they must be well cleaned from all the floss, or waste silk, which is on the outside of them, that they may play properly in the bason. The water also must be boiling hot; and as the silk they yield is of a coarser quality than the other, and has a good deal of the floss silk or *bour* upon it, the girl who turns the wheel takes the opportunity, while the other woman is preparing the cocoons in the bason for winding, to clean and pick off the loose silk from that which is already on the reel.

In winding off the fine silk, there are always two hanks of silk put upon the reel at the same time. But in winding off the silk from the double cocoons, they confine themselves to one hank only at a time upon the reel.

The next object which occurs, is the method observed by the French, in the preparation of their floss, or waste silk, which they call *piloselle;* and which they do in the following manner: All the cocoons which have been pierced by the butterflies being collected together, they add to these all the light cocoons, which they judge to be improper for winding off, after the insects have been cut out, as before mentioned; and to these they also add all the bour

toms of the cocoons which had been thrown aside from the bason, after winding off their silk.

Such of the floss silk as you wish should retain the yellow colour, you put into a large copper kettle, and cause a a person to tramp it with her bare feet, in the same manner as the women in some parts of Scotland tramp their linens when they are washing them. From time to time they turn the cocoons upside down with their hands, and so go on tramping them again with their feet. This operation is continued for nearly two hours together, turning them, and giving them a little more fresh water from time to time, till it is found that the silk of the cocoons separates properly, upon tedding it out with your fingers: and as, in tramping with the feet, the edges of the heap of cocoons will very often escape the stroke of the foot, you turn the edges into the middle, from time to time, to receive the benefit of the tramping equally with the rest.

When you find it properly separated, you carry it to the river; put the cocoons into a clean cloth tied up, to prevent the silk from mixing together. You then pour fresh water upon them from time to time, till you find that the water runs off from the silk perfectly clear, without being tinged with any sort of colour. When you find this to be the case, you spread out the silk to dry by the sun; and when it is thoroughly dry, the operation is completed.

Such waste silk as you wish to have white, is treated in the following manner: you first put the cocoons into a kettle of cold water, in which you let them lie for twenty-four hours; after which you take a quantity of water, such as you judge to be sufficient for boiling your cocoons,

and for covering them properly, which you put into a copper kettle. In this water you dissolve some good soap, giving at the rate of a quarter of a pound of soap for every pound of cocoons you intend to boil; and when the soap is thoroughly dissolved, you tie up your cocoons in a clean cloth, to prevent the silk from running together, and so put them in this manner into the kettle; when you boil them together till you see that the cocoons are grown white, taking care during the time they are upon the fire to keep the cocoons down amongst the water with a stick, that they may all be boiled equally together. When you find that they are abundantly white, you take them out, and carry them to the river, and wash them as you did the others, till the water which comes from them is perfectly clear; after which you spread them out, and dry them, as before directed, in the sun.

Though the prices of the waste silk, prepared in the two different manners above-mentioned, are generally the same; yet the merchant rather prefers the silk cleaned by means of the cold water to that which is boiled; alledging that the first loses less of its natural gum than that which is boiled, and for that reason, that the first takes all manner of dyes better than the other.

Though not in its proper place, I must beg to take notice of the following particular. As I could not, during the last of the years I resided at Montauban, get myself provided in my neighbourhood with a full quantity of leaves I then wanted, I found myself obliged to purchase the produce of several trees which grew at the distance of above a mile from my own house. The leaves were first gathered as usual in small baskets, and then put into sacks, in which last they were brought home to me. But

as this necessarily required their lying for some time in the sacks, I observed that in general when they came to hand, this had occasioned the leaves to heat, and sweat considerably, as they appeared perfectly wet when turned out of the sacks. Having an excellent dry vault or cellar, which I set apart for keeping my leaves, I had them spread upon the floor of this cellar, having first made it as thoroughly clean as possible. I then caused a servant to turn them upside down, and toss them about continually, by means of the wood-fork or grape before described, till they were perfectly dry; but taking care at the same time that this should be done in the gentlest manner, so as not to bruise any of the leaves; and I attended myself upon this occasion to be certain that my orders were punctually obeyed. The leaves were then served up to the worms as wanted; nor did I observe that their having been sweated in this manner was attended with any bad effect; on the contrary, the worms always fed heartily upon them, and continued strong and healthy till they mounted the brush-wood, and yielded me a reasonable quantity of excellent cocoons. Reflecting upon this accident, it appeared to me, that the practice of sweating the leaves might turn out to be beneficial in a climate that was not so dry as the south of France; in England, for example, which was the object I always carried in view, as a great deal of the gross moisture of the leaves might by that means be discharged before they should be given to the worms; and, indeed, that seems to be the more necessary in the present state of our mulberry plantations, the most of our trees, as far as I have been able to learn, being planted in garden grounds highly manured, which of course renders the leaves too rich and succulent to form in this natural

state a proper food for the worms: nay, in France, as already observed, they are regarded as highly dangerous for that insect. Would it not therefore be proper, if the Society should be pleased to recommend this matter to be fully examined by experiments, to have the truth ascertained, as it is certainly of importance, that the most wholesome food should be provided for the use of the worms.

Wishing to know what was judged to be a reasonable return in silk, from an ounce of eggs, I took the opportunity of putting that question to a gentleman of great practice in this culture. His answer was, that he reckoned himself very well off when he had at the rate of five pounds of silk from an ounce of eggs; though he said he had sometimes got six, seven, eight, and even nine pounds per ounce; nay, he had known others get as far as ten pounds per ounce. But he repeated, that he thought a man had full reason to be satisfied with five pounds of silk per ounce, more especially if his quantity of worms were large, as the larger the quantity of worms, the return of silk must of course be less in proportion, as it was utterly impossibly to pay the same just and accurate attention to the culture of a very large number, that can certainly be given to a smaller quantity.

Here I shall beg leave to add a few general remarks. That it is computed in France, that it takes two hundred and twenty cocoons, when tolerably good, to weigh one pound.

That the number of worms requisite to produce one quintal of cocoons, will require from twenty-two to twenty-three quintals of leaves for their food.

That one quintal of cocoons will yield only from nine to ten pounds weight of spun silk.

That the cocoons, one year with another, sell for twenty-five sols per pound.

That the spun silk, when thoroughly cleaned and prepared for the loom, will be diminished in quantity nearly one fourth. And,

That a pound of spun silk, one year with another, sells in France for twenty-five livres.

I shall close these observations, by begging leave to throw it under the attention of the Society, whether it might not considerably promote the object they have in view, to encourage the two following particulars; the first, the forming plantations of the white mulberry tree, upon the soil which has been found in France to be the most proper for this purpose; namely, upon gravel or sand which ought to be thoroughly cultivated yearly, but without suffering any manure to be put upon it. And the other, the raising the white mulberry tree annually from seed, which is undoubtedly the quickest and most expeditious way of getting a proper supply of these trees; and which will have this additional advantage, as by this means a continued succession of tender young leaves will be obtained for the use of the worms in their early state, as these are beyond a doubt the best food for them till they have got over their first two ages.

Along with the foregoing observations, I think it may not be improper to lay before the Society the following particulars, as they help to throw additional light upon the subject.

It having been the general opinion in France, when I resided in that country, that some great errors had crept in as to the management of the culture of silk, which occasioned a heavy loss to the kingdom, Monsieur Marteloy of Montpellier, the gentleman already mentioned more than once in the foregoing observations, with a view to trace out the faults of that management, and to endeavour if possible to remove them, carried on a course of experiments, during no less than eighteen years successively, before I went into that country, by means of which he was satisfied he had traced the evil to the bottom; and insisted that their want of success in that culture was entirely owing to the causes following, namely, that proper attention was not paid to that cleanliness which was absolutely requisite to keep the worms in health and vigour: secondly, that the practice was to crowd the worms most improperly into too small bounds: and, thirdly, that they absolutely destroyed all hopes of success, by keeping their worms too close, by secluding all external air, which had the effect to render the air of the room perfectly noxious and destructive to the worms; which of course occasioned a great mortality to these insects. Upon this subject he prepared a memorial, to be laid before the French minister, of which he favoured me with the perusal, and from which I took notes, which enable me to lay before the Society the substance of that memorial, which was couched nearly in the following terms.

Monsieur Marteloy began his memorial by representing to the minister, that if a fabricqueur (the person who employs himself in the culture of silk) has got a room fifteen feet high, eighteen feet broad, and eighteen feet long, he has not the least difficulty to make use of twenty

ounces of eggs, which, if tolerably good, ought to produce eight hundred thousand worms; and these, when come to maturity, he observed, would be of the size of a man's finger, and could never be possibly contained in one room of the above dimensions, if this insect, like all other creatures, was not accustomed to die at all different ages. I suppose then, said Monsieur Marteloy, that at their fourth age or malady, the half shall have perished, by which means there remain four hundred thousand, a number still far too great to be properly contained in a room of this size, if one attends to this circumstance, that the space of one foot square is necessary to contain properly one hundred worms. The multiplicity therefore of the stages in this case will be so great, that they will nearly touch one another. In fine, the place will be no better than a great mass of stages, of filth, and insects, which must produce an infected air. Add to this, the cruel usage of keeping the room close shut up; the exterior air by this means absolutely excluded, and as to the internal air, in which there is scarce a probability of breathing, they are in use to try to correct it by fumigations, which in fact only add to the calamity.

During the first two ages, the silk worms, which occupy but about two stages of the whole, on account of their being so small, and from the little room they take up, succeed to the wish of the fabricqueur, who flatters himself with the hopes of a happy result.

The third age arrives, when the silk worms are increased one-eighth part more in size, and which will then occupy sixteen stages. From that moment the fabriqueur becomes the cruel destroyer of his own prospects. He shuts the door and windows, caulks up every crevice with more care

than ever, which could admit the least degree of exterior air; he heats the room at great expense, and actually suffocates his worms by the force of fumigation.

During the first two ages there is not an absolute necessity of having fresh air introduced into the room; since the worms scarce occupy at that time a twentieth part of the room, the filth dries of itself, it not being above an inch thick, or an inch and a half at most; but the whole face of things is changed at the third age: the worms, as I have already said, do then occupy sixteen stages, and every day increasing in size to the time of their maturity, soon fill the whole room. The litter increases by reason of the great quantity of leaves they eat, and by their excrement. During the continuance of that age, the litter will increase to the amount of five or six inches. The interior air, full of a poisonous humidity, which evaporates from the worms, leaves, and excrement, prevents the litter from drying: always wet, it presently heats, and the silk-worms being no longer dry, begin by losing their vivacity, and end by a distaste of their victuals, even when the best chosen.

Sometimes the insect, well conditioned and vigorous, keeps up against all these evils during the third age, and sometimes even gets over the fourth; but the moment of maturity, or of mounting, being come, oppressed and infected at last by so many evils, he can support it no longer. In vain the fabriqueuer expects to be paid for his labour; his worms, which have lived in that prepared pestilence, if it may be so called, refuse to mount in order to make their cocoons; the fabriqueur, anxious for the success of his crop of silk, endeavours to assist them with his hands

which evidently increases their distress. Unable to support themselves upon the branches, they descend, or tumble down, and do nothing but throw out some little threads of silk, without design. In fine, they have not the strength to form the rich tomb in which they ought to shut themselves up, in order to propagate their species.

In that sorrowful and tragic condition, the master sees his entire ruin! In despair, he betakes himself to remedies, and the fumigations totally complete the destruction of the whole.

The poorest villages, where the houses consist only of so many huts, ready to tumble to pieces, turn out to be the places where they have the richest and the most certain crops. These habitations, almost entirely open, in spite of all the care to shut them up during that operation, have always crevices sufficient to admit a fresh circulation of air, which is the true cause of their success. Their richer neighbours, better lodged, and consequently better shut up, astonished at the happy success of these poor people, call them in to be directors of the management of their silk-worms. These new comers, transplanted into the more commodious, but less healthy houses, have no longer the same advantages they enjoyed in their own shattered habitations, and consequently have no better success than those who called for their assistance. The low class of people carry their stupidity to such height as not to be sensible in what consisted the advantages of their own open houses, which, unknown to themselves, kept up always a continued circulation of fresh air. They commonly attribute this want of success in these

operations to foreign causes, to cold, to heat, to the air of that particular spot, to particular winds which may happen to reign at that time, to the nature of the soil, to the quality of the mulberry leaves, to the women who attend the worms being in a certain situation at that time; and such other ridiculous causes, without any meaning.

From the foregoing narrative of the ills which attend the present practice of cultivating the silk-worm, one may with justice condemn it as highly improper and ruinous. A gentleman, desirous to find out the true causes of the want of success in this lucrative branch of commerce, was at the utmost pains, for a tract of years together, to examine into the management of those employed in this article through a great part of Languedoc. Suspecting that the want of success in the present management might proceed from want of cleanness, and want of fresh air, he began by small experiments, which but the more confirmed him in that suspicion. With a constant attention in keeping them clean, that is, taking away the litter very frequently, to prevent all humidity and danger of fermentation of the litter, he, for the space of eighteen years together, went on, by little and little, giving always a larger degree of fresh air in every new experiment, till at last he found, that after the second age that insect was hardy enough to be reared in the open air altogether; and that by treating them in this manner, he entirely avoided all the distempers to which this insect was liable, when treated by the former practice, and never failed to have a plentiful crop.

The pernicious method hitherto used in the culture of the silk-worm has not only been the cause of the many

distempers to which that insect is liable in France, and the great mortality which happens yearly amongst them: it has still been attended with worse consequences; for women who have children at the breast, being often employed to attend the silk-worms, and give them their food, &c., the milk of these women has been but too often affected by the pestilential air of the confined rooms, which has yearly cost the lives of many of the young children. It has been remarked, that for many years past, numbers of children at the breast have died yearly in those parts of the country where they rear numbers of silk-worms, particularly at Tiers, Narbonne, Castrie, &c. The time of rearing the silk-worm is not the season of fruit, nor the time when the earth requires great labour, as at that time almost all the crops of every kind are in their infancy. One cannot then attribute that mortality amongst the children at the breast to any of the above causes, but solely to the nurses being in the habit of attending the silk-worms for several weeks together, in that close and pestilential air above-mentioned. It has been remarked, that all of these, either men or women, who are employed in attending the silk-worms, who have any kind of simple wounds, that those wounds have turned into incurable ulcers.

Is it then extraordinary, that nurses, who pass three weeks together at the hardest work, and in the most infected air, should give a kind of pestilential milk, which occasions that mortality amongst the children? They are seen, after that hard labour, to be in a languishing condition themselves for several months together. That kind of jaundice which attacks those women who ordinarily have the charge of attending the silk-worms, does it not evidently demonstrate the cause of their illness? The ex-

dess of labour might well occasion their growing meagre; but it does not ordinarily give that yellow livid colour which we remark always in those who raise large quantities of the silk-worms. That method of culture ought then to be avoided, as being evidently so prejudicial to the human health; and the new method, before pointed out, should certainly be followed, as the continual circulation of fresh air not only prevents all those bad effects upon the health of those persons who are employed in rearing the silk-worm, but also secures a certain and rich crop of silk, by keeping the worms always in full health and vigour.

In consequence of the foregoing memorial, the states of Languedoc, upon the recommendation of the minister, appointed an experiment in the open air, to be carried on publicly in the garden belonging to the Jesuit's College at Montpellier, under the direction of Monsieur Marteloy, and ordered the sum of twelve hundred livres to be paid to him, for defraying the expenses of it. This experiment was accordingly carried into execution in 1764: and as I happened to reside at that time at Montpellier, I regularly, during the whole course of it, attended to its progress twice a day, taking care as regularly to mark down in my notes the state of the weather daily, and every other occurrence which seemed to demand my attention. This experiment naturally drew to it the public notice, and the people engaged in that culture flocked in from every quarter to observe the result. To their no small astonishment, the experiment succeeded in the most perfect manner! And the report of its success having been made to the minister, the states of Languedoc were advised by him to order a second experiment of the same kind to be

made the year following, which they accordingly did, appointing Monsieur Marteloy again to conduct it, to whom they ordered eighteen hundred livres to be paid, for defraying the expense of it. Here it is to be remarked, that eight pounds and a quarter of the cocoons, raised in this first public experiment in the open air at Montpellier, yielded a pound of silk; whereas it required twelve pounds of the cocoons raised the very same season in the house to yield a pound of silk.

The second experiment, carried on publicly in the open air, took place in 1765, which I likewise attended with the same punctuality. It had, however, a very different issue from the former; for that second season having turned out uncommonly cold and wet, the worms, though the top of the stage was roofed with boards to throw off the wet, like our sheds in England, were frequently drenched with the rain: and at the most critical time of their growth, namely, from their having got over their fourth malady, to the time of their mounting, the heavy rains continuing almost incessant, laid Monsieur Marteloy under the unavoidable necessity of giving them their food wet, as there was not the least possibility of getting the leaves dried. The consequence was, that the experiment failed; but, indeed, not more so than this culture failed almost everywhere else in Languedoc, where the worms were all reared in houses, owing, without doubt, to the extreme wetness of the season.

Though this last failure put an end to any further attempts to raise the worms in the open air, the consequences, however, of these two experiments were yet productive of great advantages to the country; for many of the people engaged in that culture, having been made perfectly sen-

sible of the great errors in their former management, were led to adopt the alterations recommended by Monsieur Marteloy, namely, not to overcrowd their worms as formerly; to observe more cleanness, by frequently clearing away the litter; and, lastly, by taking care to preserve the air of the rooms always sweet, by a continued circulation of fresh air, which certainly form a very material alteration in their practice for the better.

Whether owing to Monsieur Marteloy's experiments, or not, I will not pretend to say; but certain it is, that at this time a spirit for extending the silk culture greatly spread itself all over Languedoc. Amongst those who distinguished themselves the most, were the proprietors of the Royal Canal of Languedoc. As these gentlemen were proprietors of both the banks of the canal, for the purposes of their navigation, they formed the spirited resolution of planting entirely with the seedling white mulberry the whole banks of the canal, from one end to the other, which, from the town of Agde to Thoulouse, forms a stretch of nearly one hundred and twenty miles.

The care of carrying into execution these extensive plantations they committed to Monsieur Marteloy, upon whom they settled a handsome appointment for defraying the expense of his living and travelling charges. And, with a view to fix down his attention still the more closely to the duties of his charge, they likewise bound themselves, by contract, to communicate to him a tenth share of the free profits of these plantations, for a certain number of years.

Nor was this all; for the same gentlemen carried their views of this kind still further. Being possessed of an extensive property in land, which at that time lay entirely

open, they ordered the whole of it to be enclosed with hedges of the seedling white mulberry; and the carrying on this second operation they likewise entrusted to the care of Monsieur Marteloy. These particulars I had from Monsieur Marteloy himself, whom in the autumn of 1767 I met with at Thoulouse, and where I left him busily engaged in forwarding these spirited operations committed to his charge, which he told me were going on rapidly, as his employers liberally supplied him with the funds necessary for that purpose.

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IN AGRICULTURE.—CLASS I.

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Mr. James Long's.
The Children of the School at Adbury.
Lucy Hollowell's.
Mary Marshall's.
The Children of the School at Bandon.
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Anne Dyer's.
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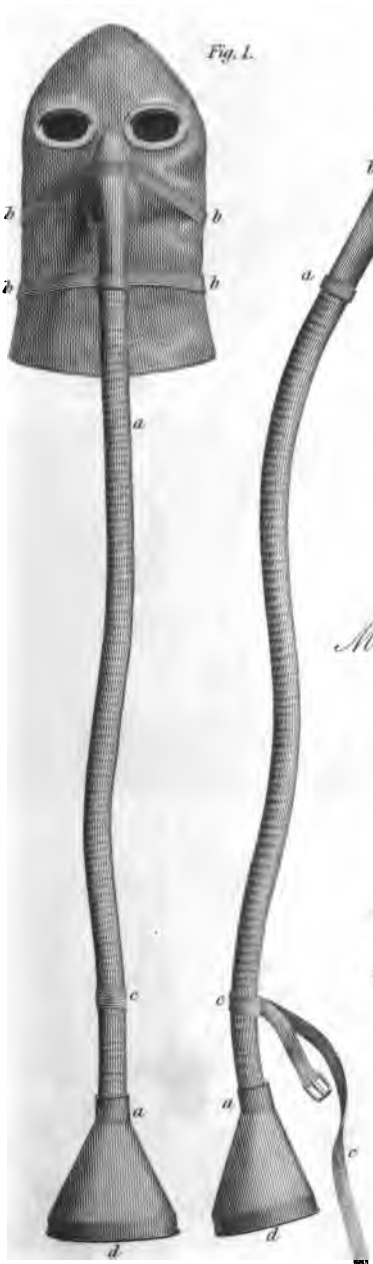
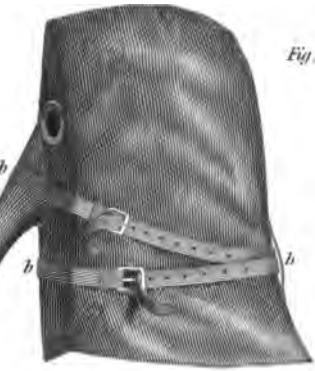
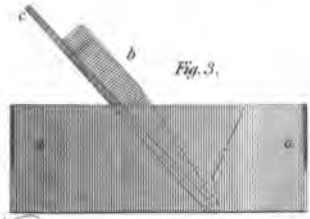
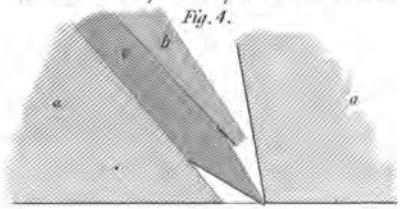
Mr. Roberts's improved Hood for enabling persons to breathe in thick Sm



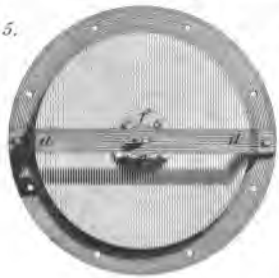


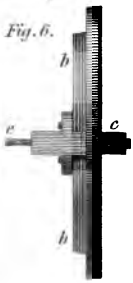


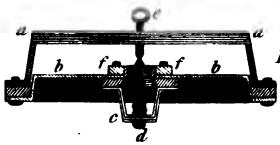
Mr. Williamson's plane for hard Wood.



Mr. Sockl's improved safety Va



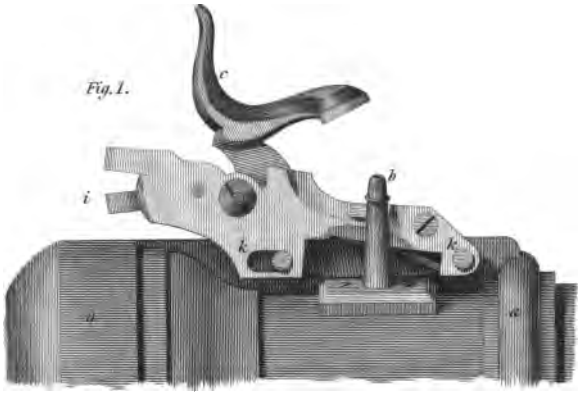


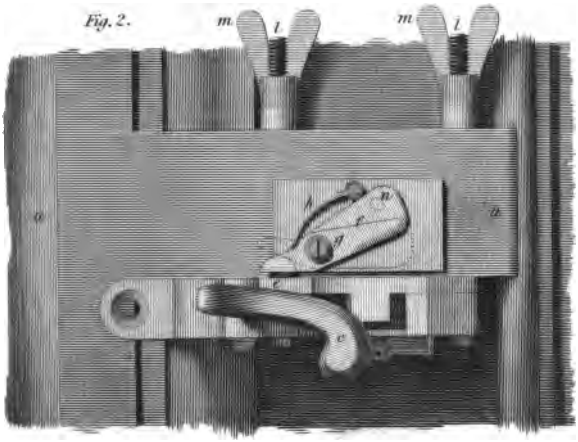


Drawn by H. W. Reveley.

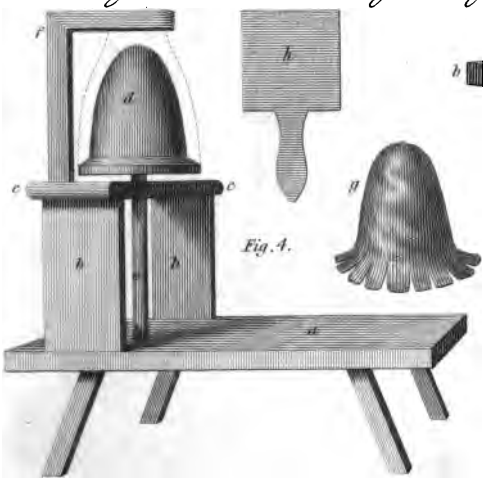
E.

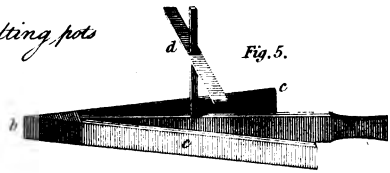
Capt. Dickinson's percussion lock for Ships guns



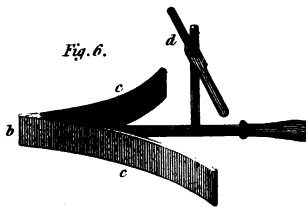


Mr. Anstey's apparatus for making melting pots





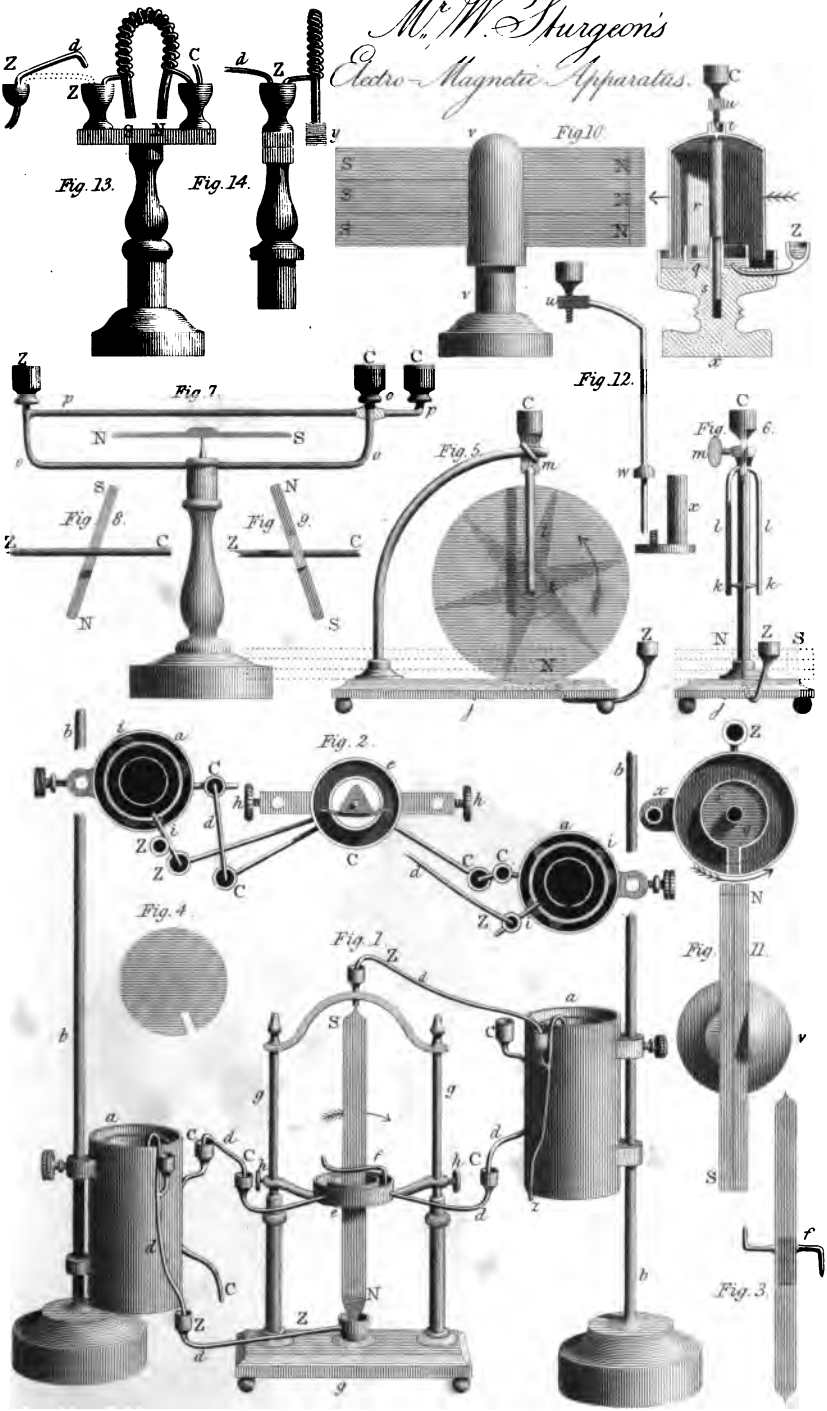
Mr. Griffiths' spring wedge.



Drawn by H. W. Reveley.

Engd. by

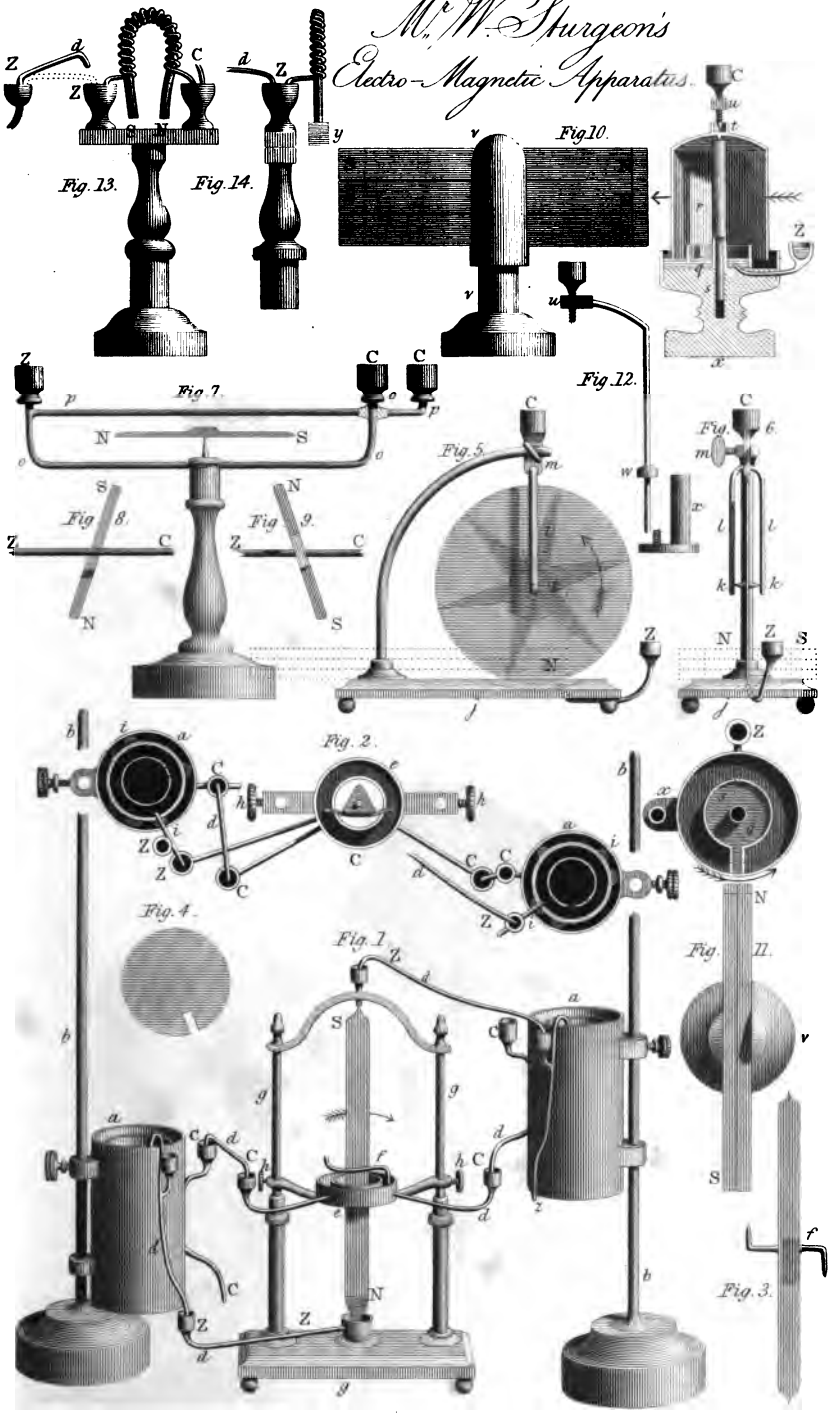
Mr. W. Sturgeon's Electro-Magnetic Apparatus.



Drawn by Cornelius Varley.

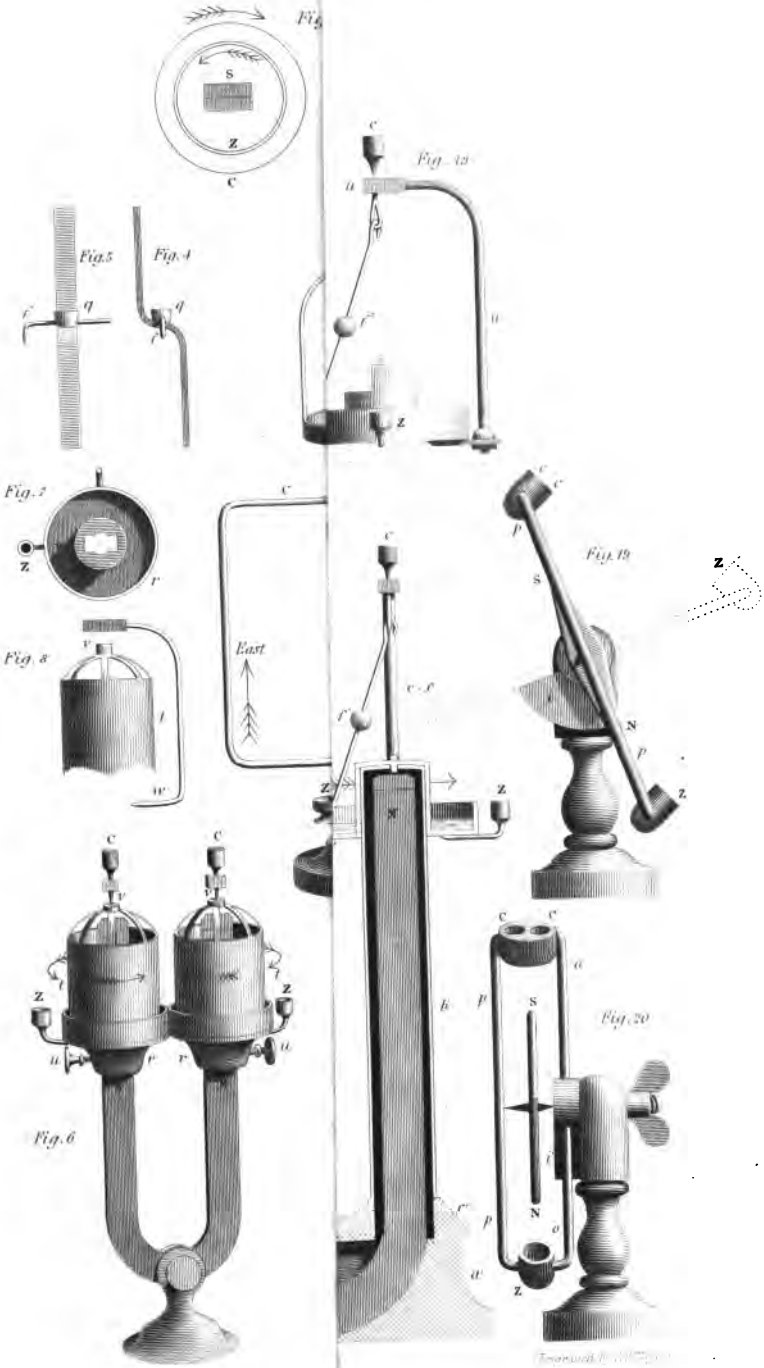
Engraved by J.B Ta

Mr. W. Sturgeon's Electro-Magnetic Apparatus.



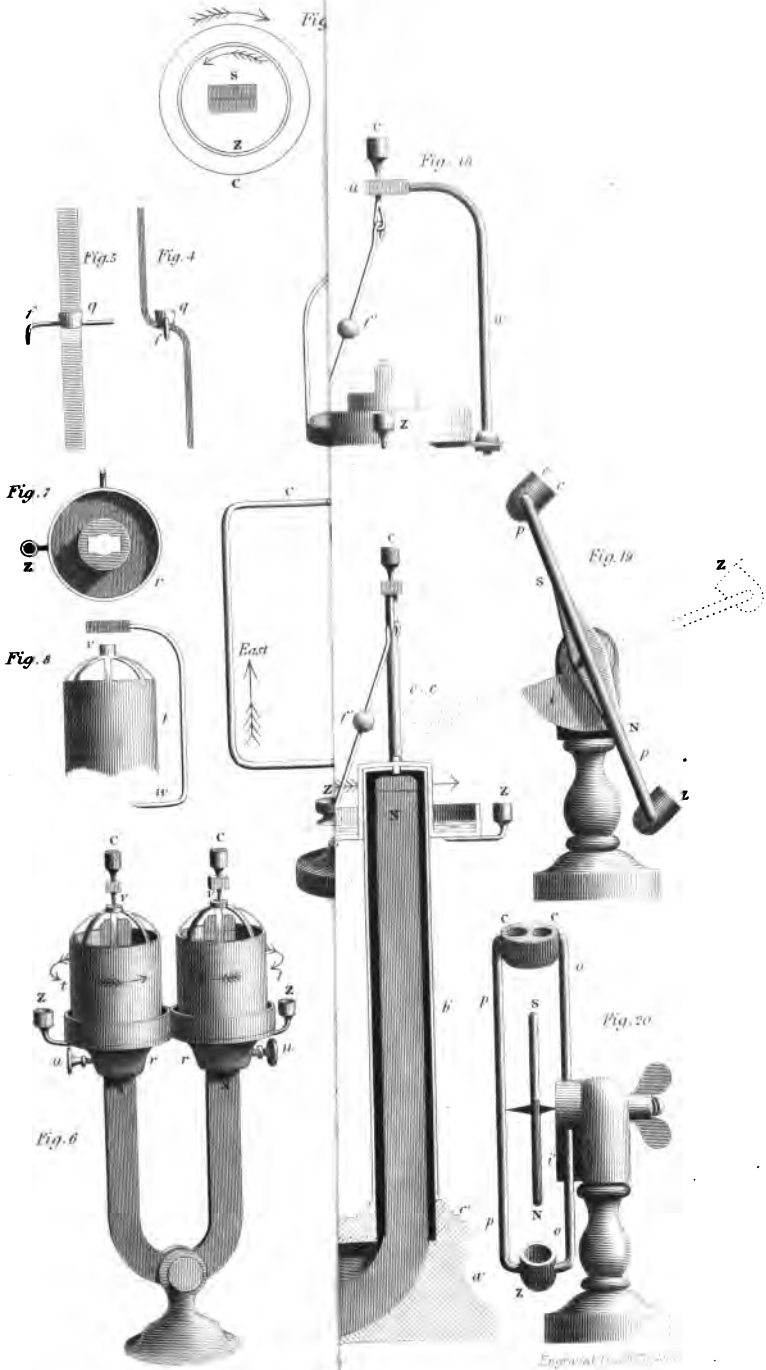
Drawn by Cornelius Varley.

Engraved by J.B Taylor.



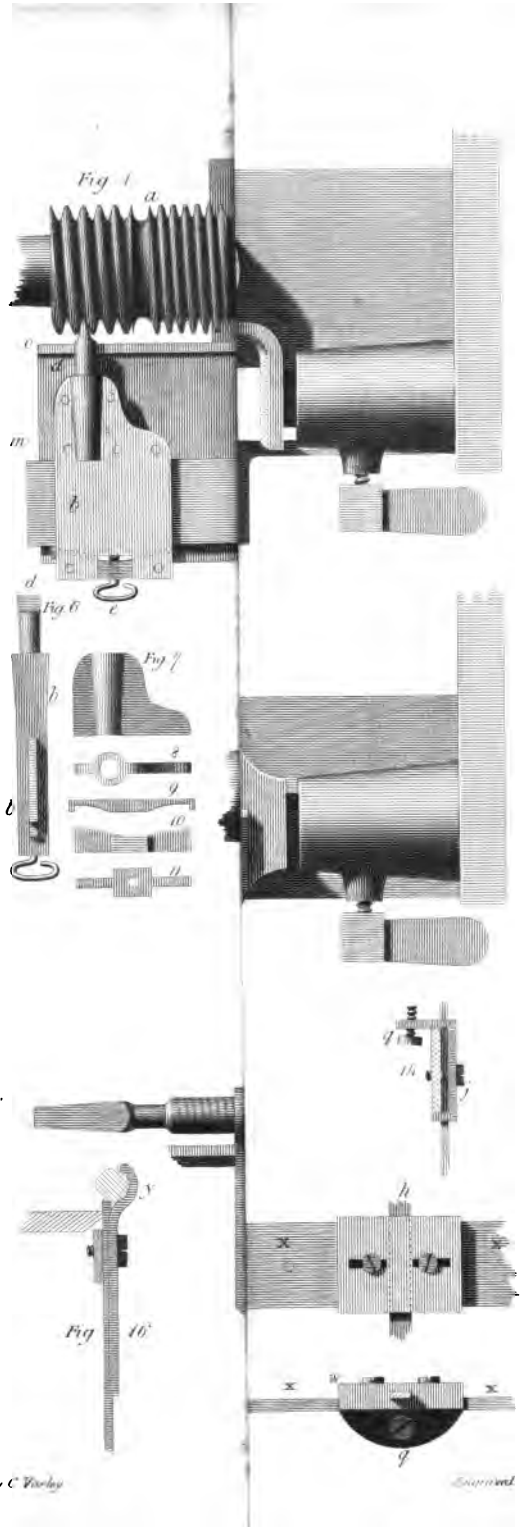
Drawn by Geoghegan Hardy.

Engraved by [illegible]



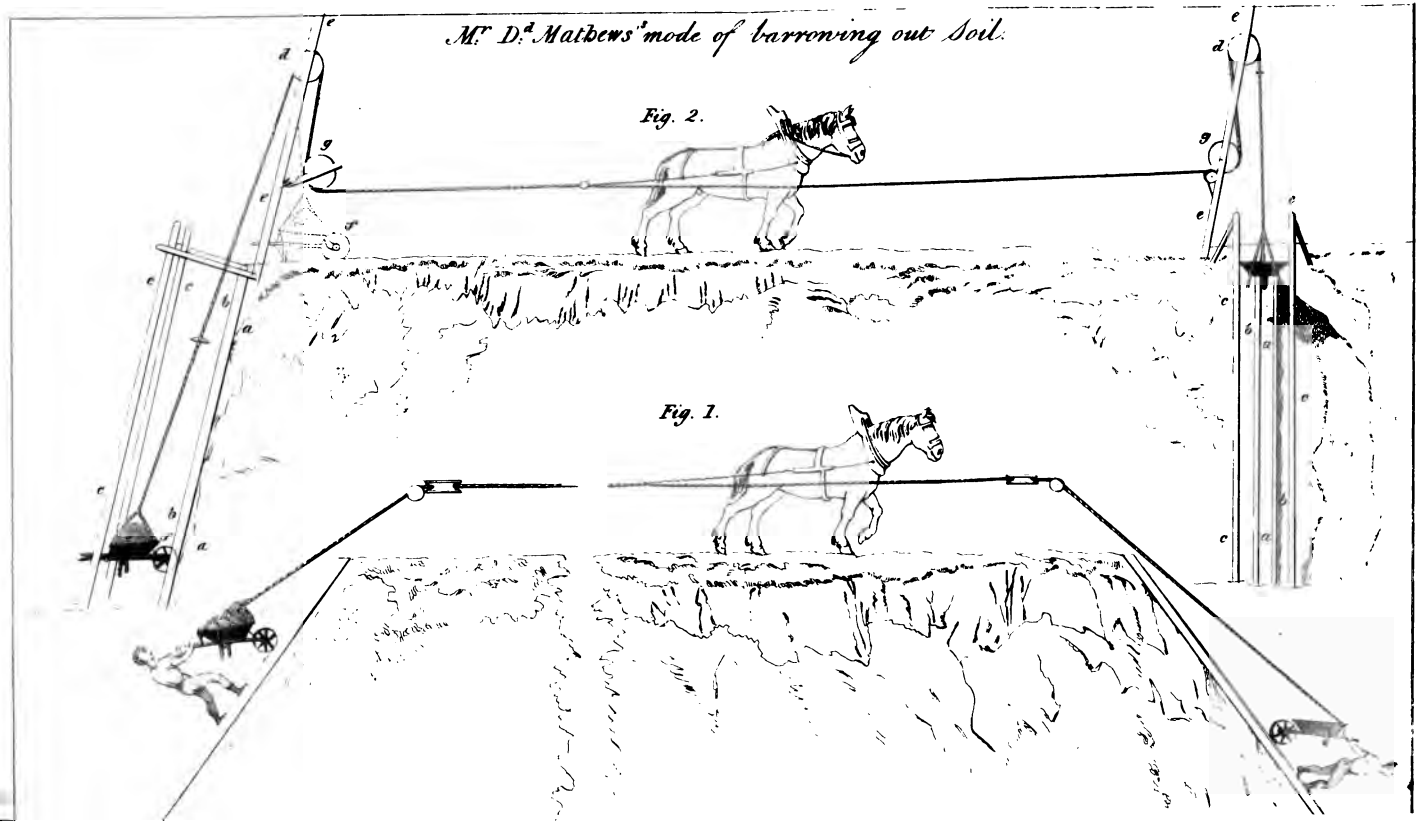
Drawn by Geneline Tinley

Engraved



Drawn by C Varley

Engraved by J B Taylor


Mr. Dd. Mathews's mode of barroving out Soil.
Fig. 2.
Fig. 1.

Mr. W. Friends Secret Lock.

Fig. 1.

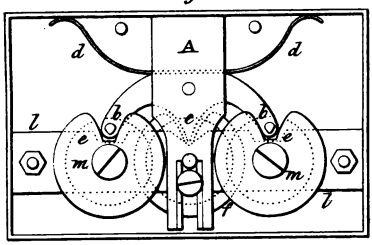


Fig. 2.

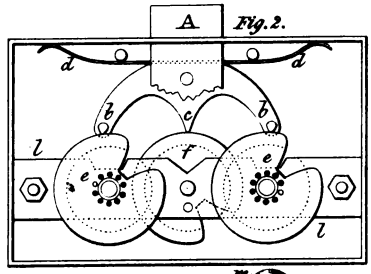


Fig. 3.

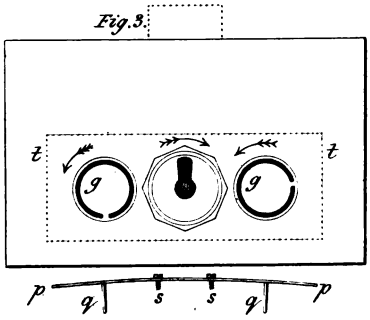
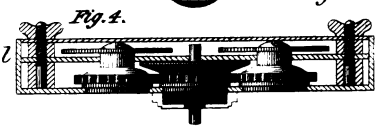


Fig. 8.

Fig. 5.

Fig. 10.

Fig. 4.



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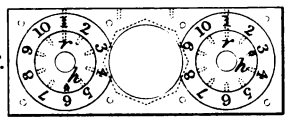


Fig. 11.

Fig. 9.

Fig. 12.

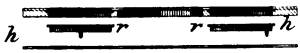


Fig. 7.

Mr. J. P. Hubbards.

Chair.

Fig. 13.

Fig. 14.

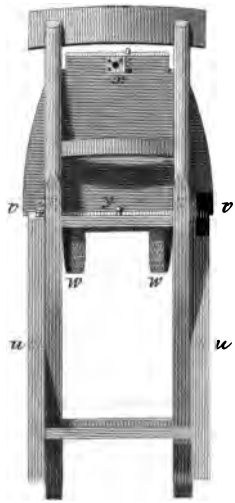
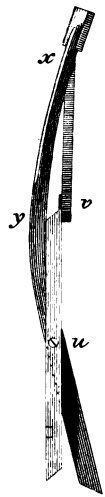


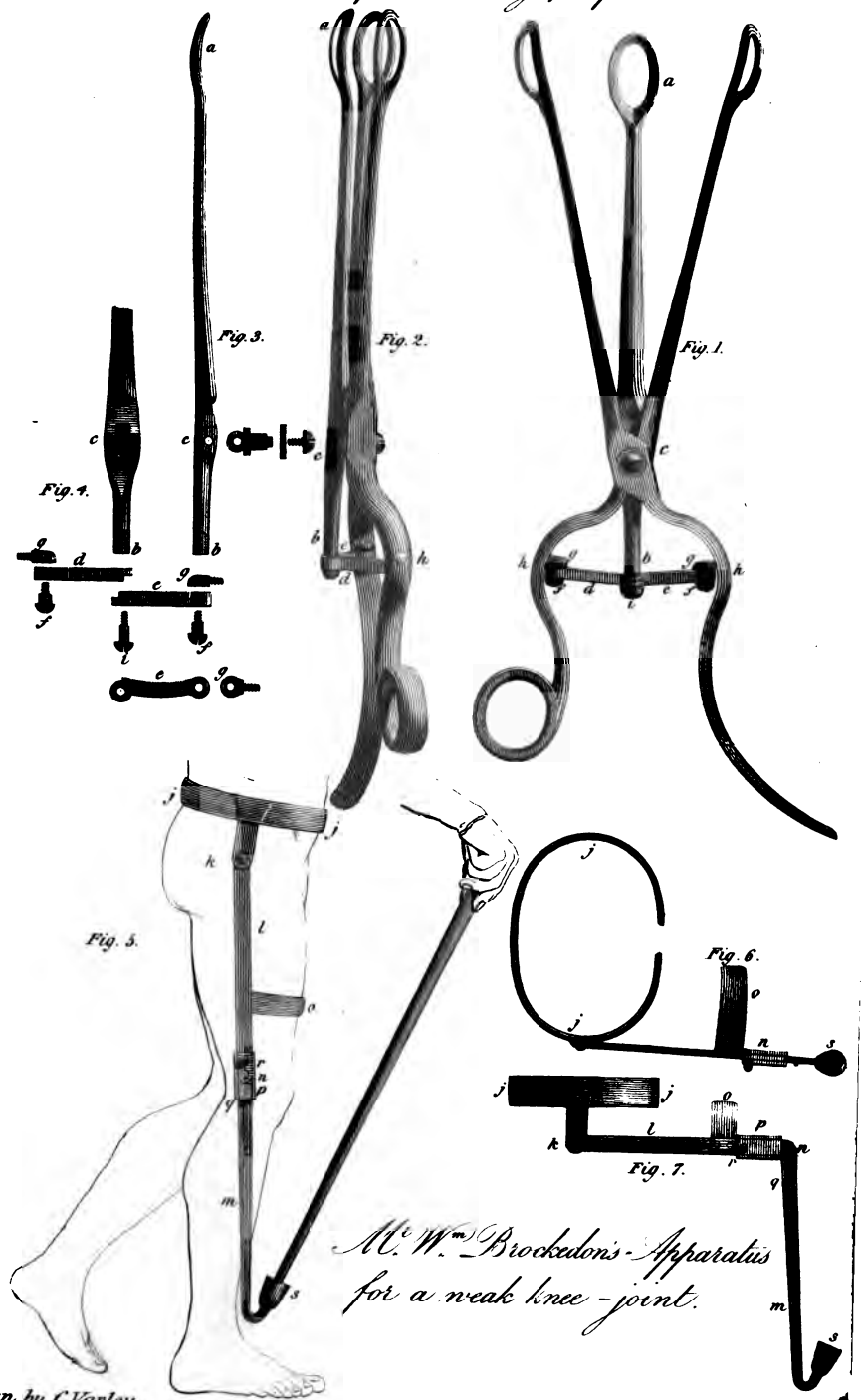
Fig. 15.



Drawn by Jas. Dis Darley.

Engraved by

Mr. T. Cluley's Lithotomy forceps.

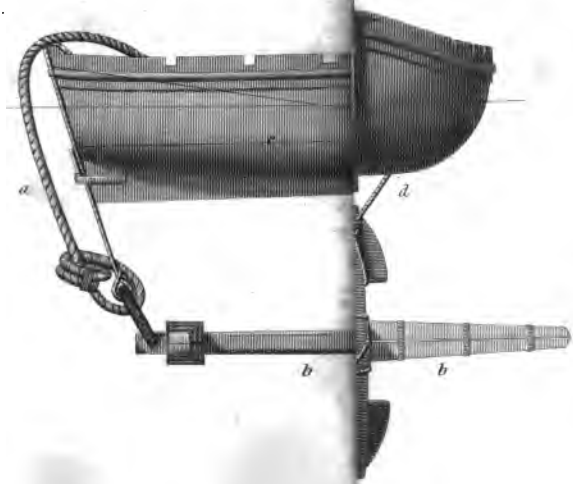


Mr. Wm. Brockedon's Apparatus for a weak knee-joint.

Drawn by C. Varley

Engraved by Jr

Fig. 2.



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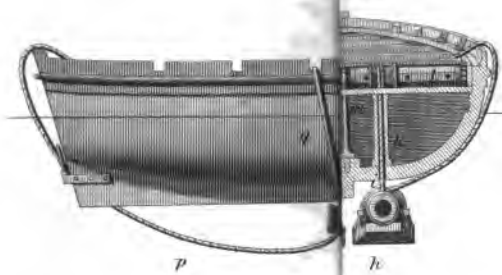

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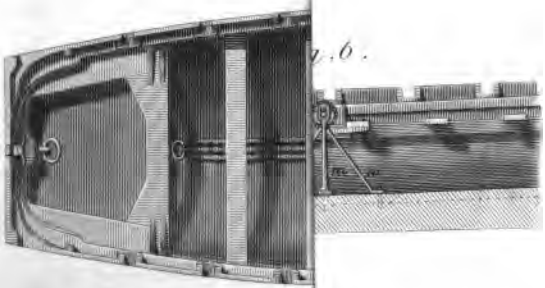
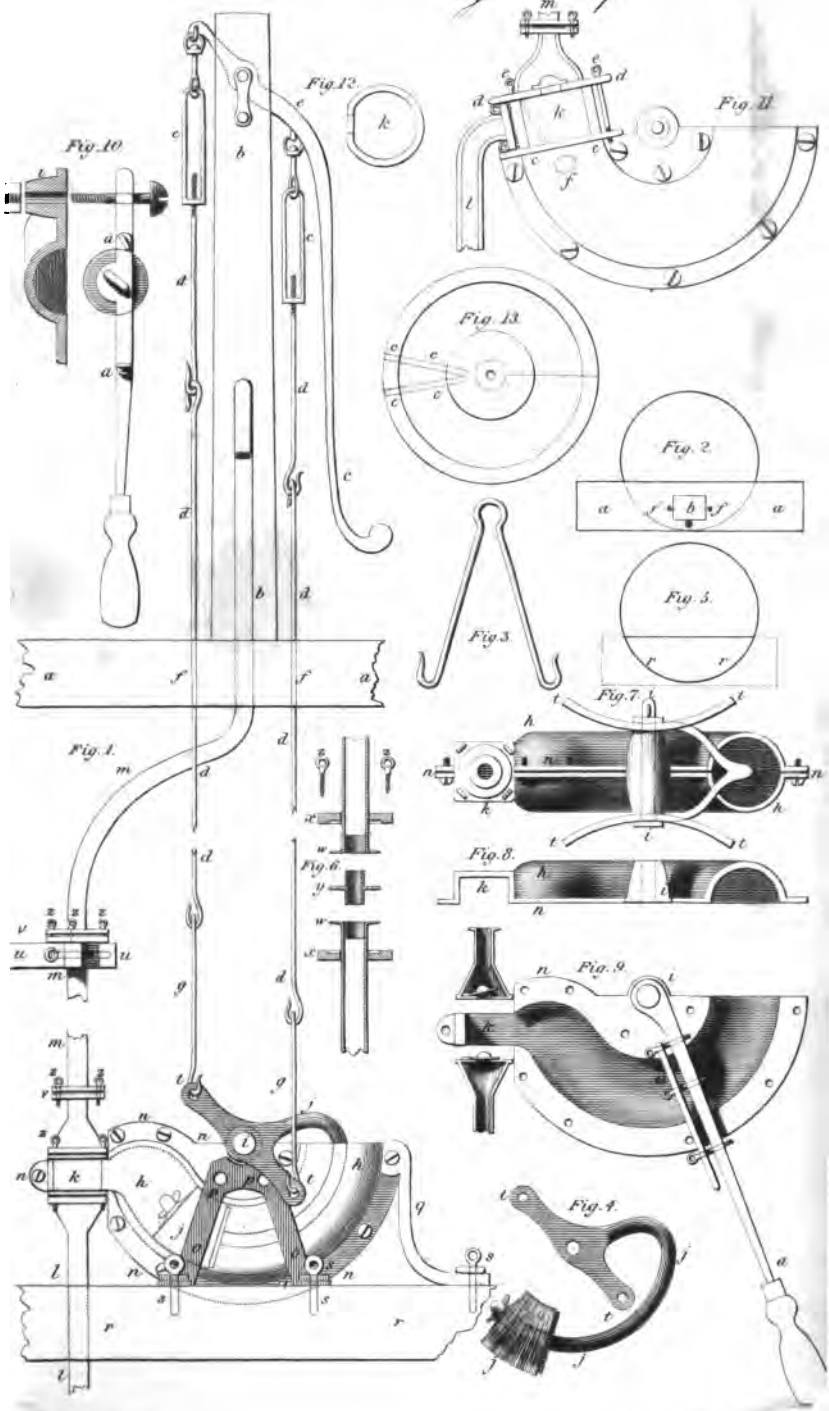


Drawn by H.W. Reeder.

Engraved by G. Gladwin.

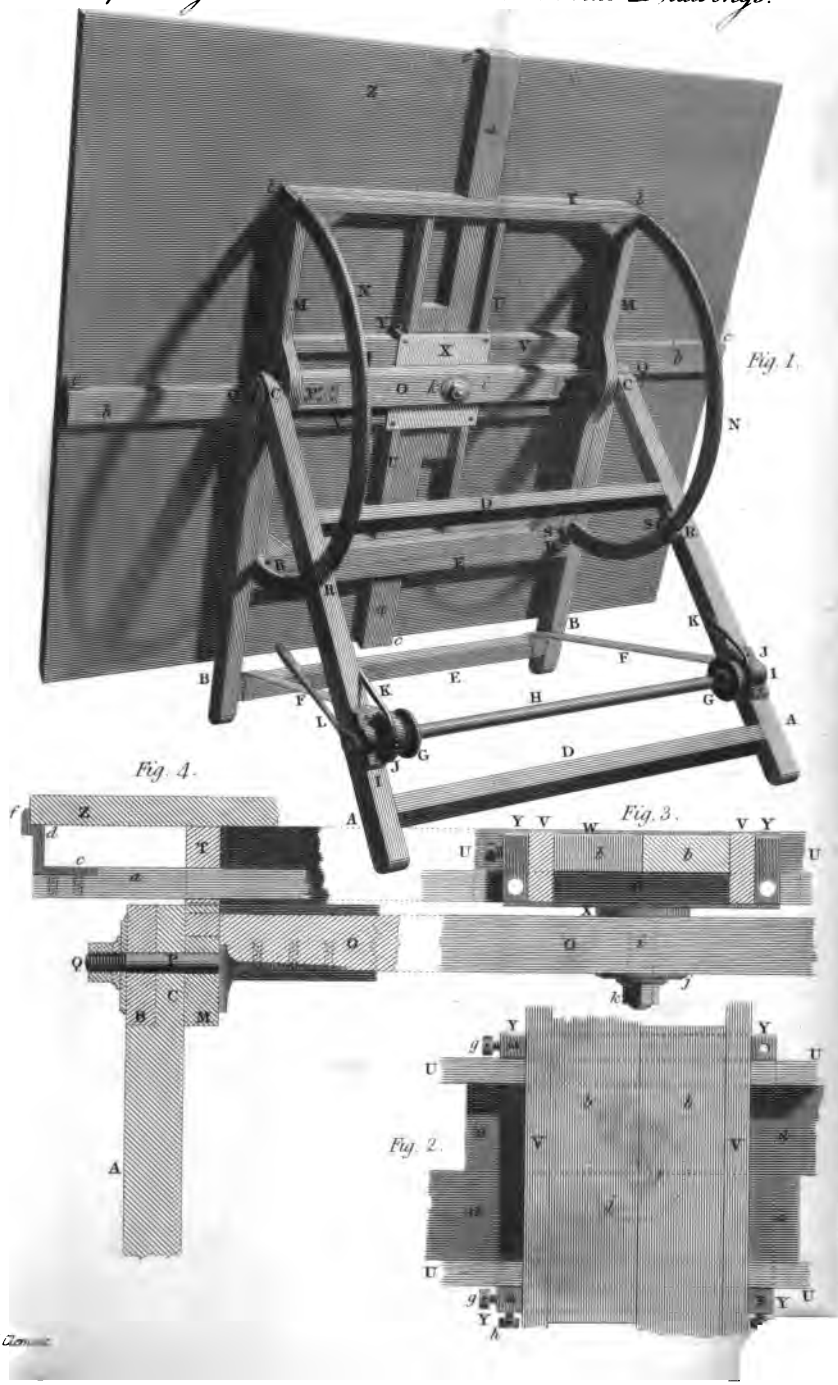
Mr Elisha Pacey's Pump.



Drawn by C. Varley.

Engraved by

Mr. Joseph Clements's Drawing Table,
for large Mechanical and Architectural Drawings.



Drawn by J. Clements

Mr. H. Hardy's Intervals of Time.

Fig. 1.

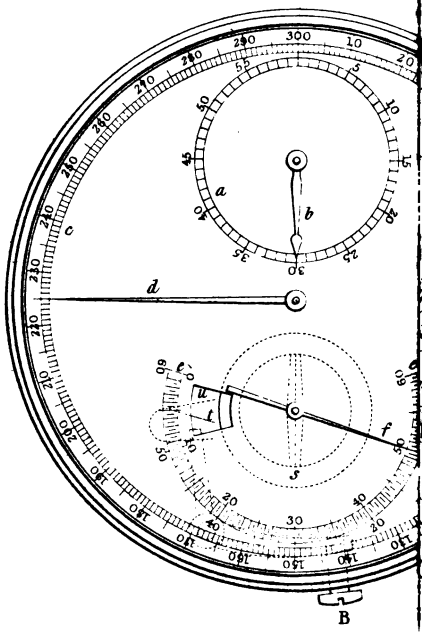


Fig. 2.

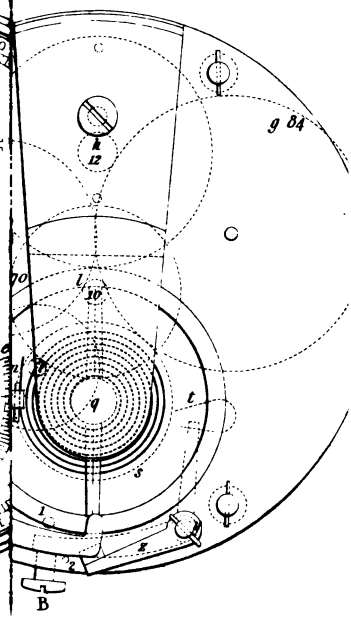
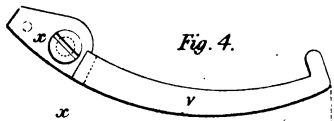


Fig. 4.



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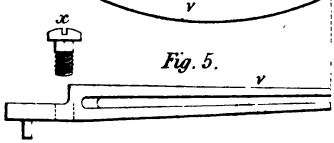
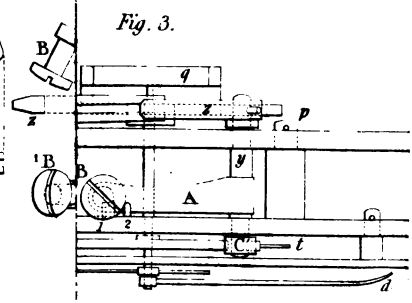


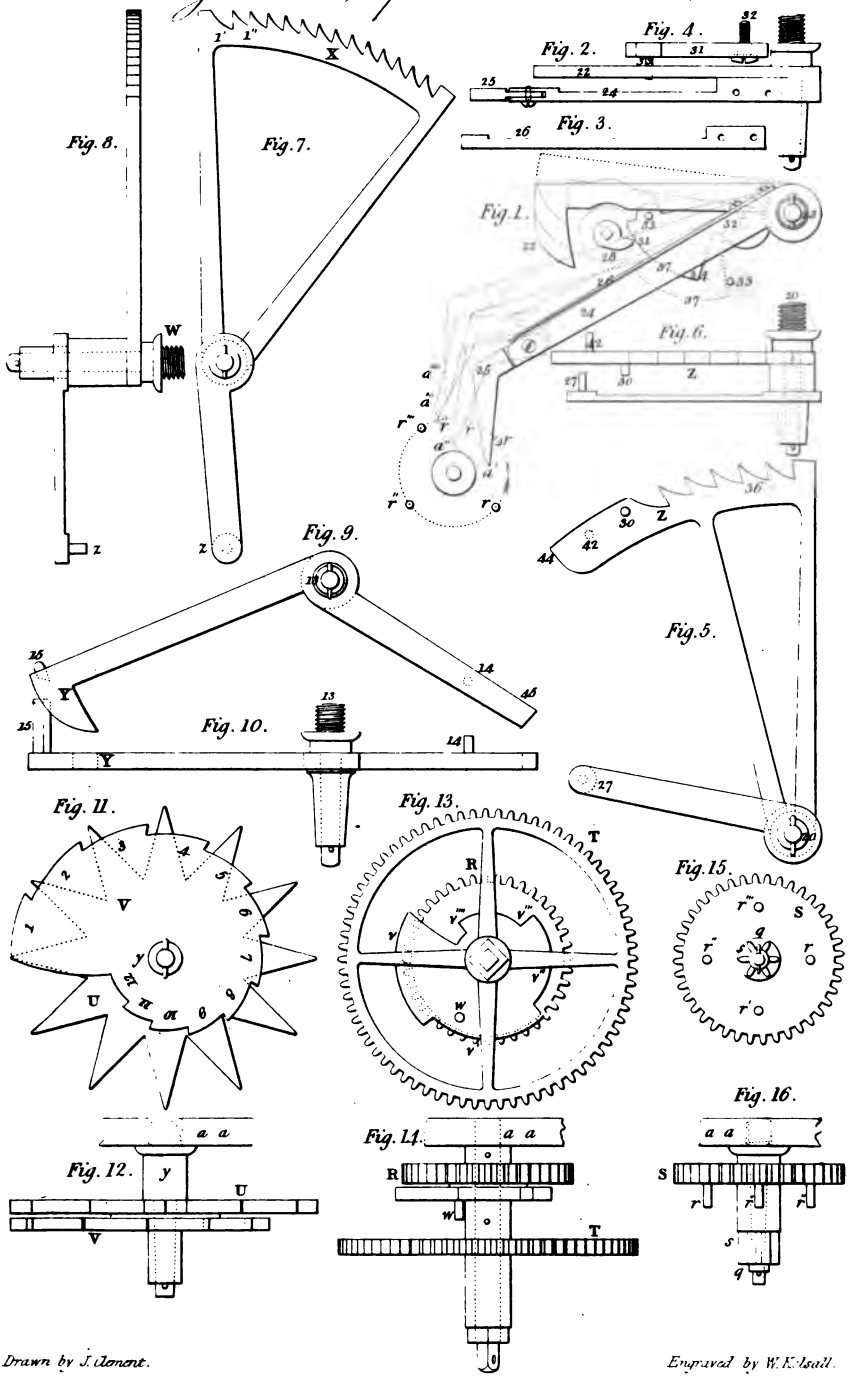
Fig. 3.



Drawn by J. Clement.

Engd. by E. Kern

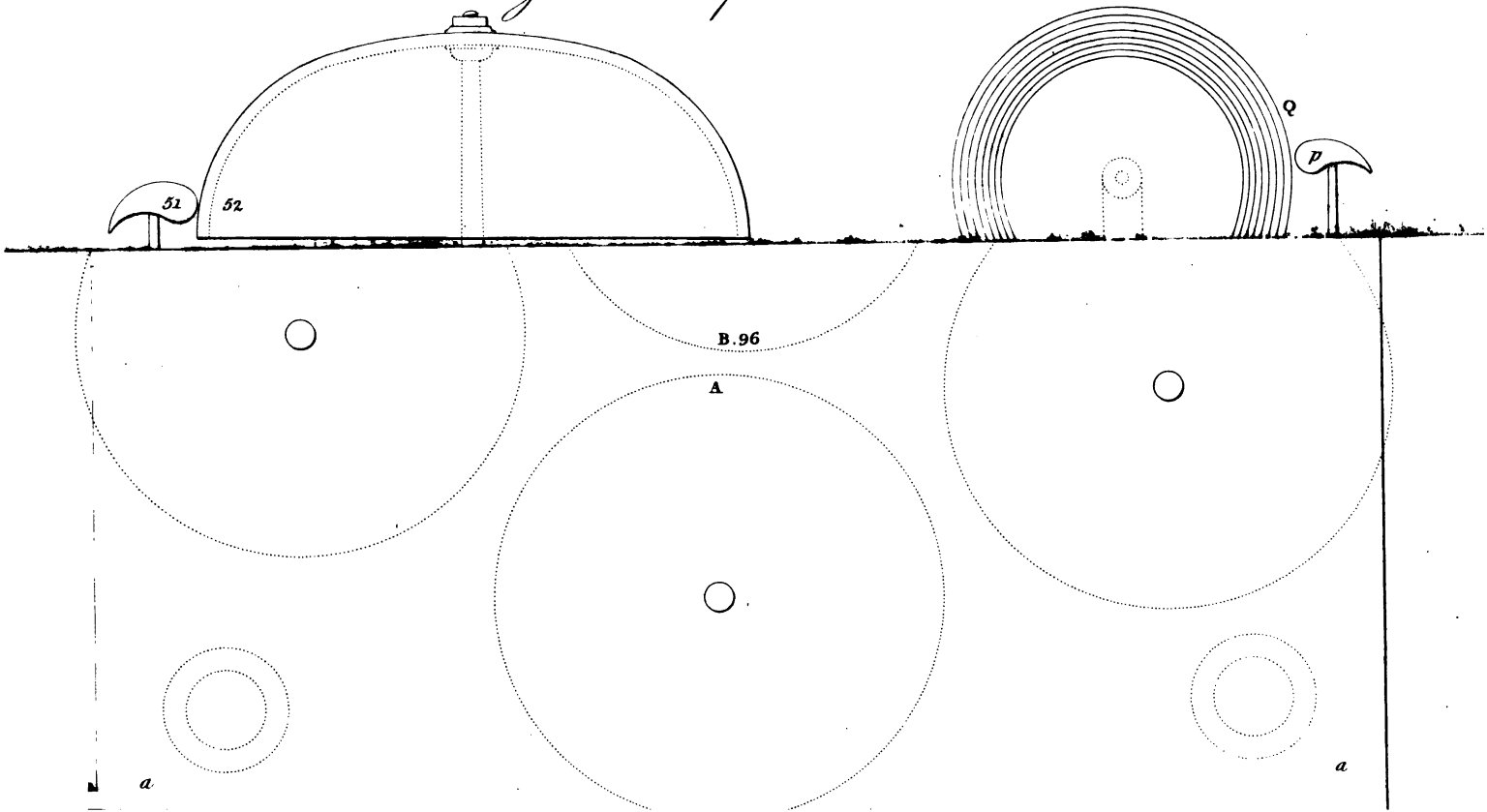
Mr. J. Aitkin's improved Quarter Clock.



Drawn by J. Clement.

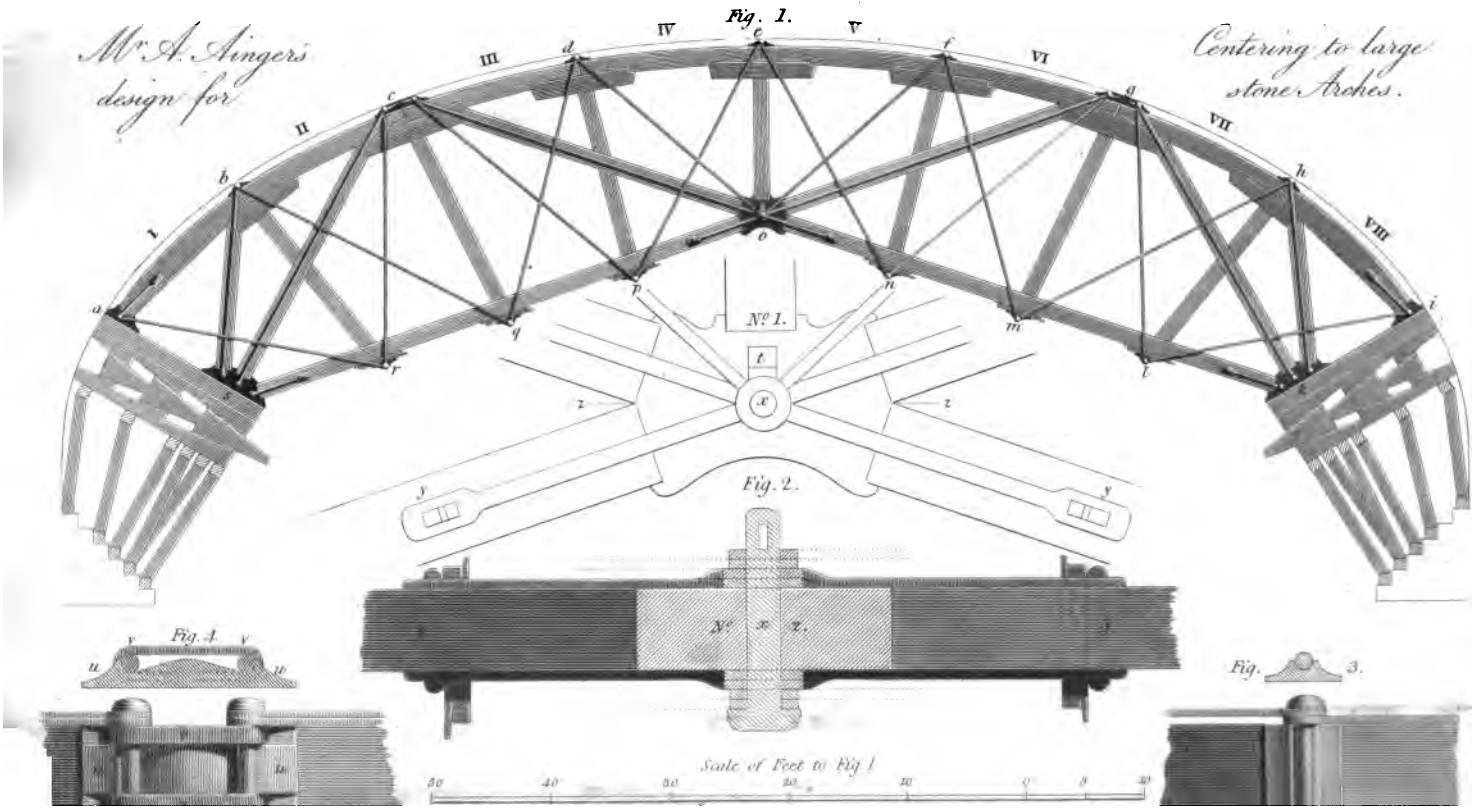
Engraved by W. Kelsall.

Mr. J. Atkin's improved Quarter Clock.

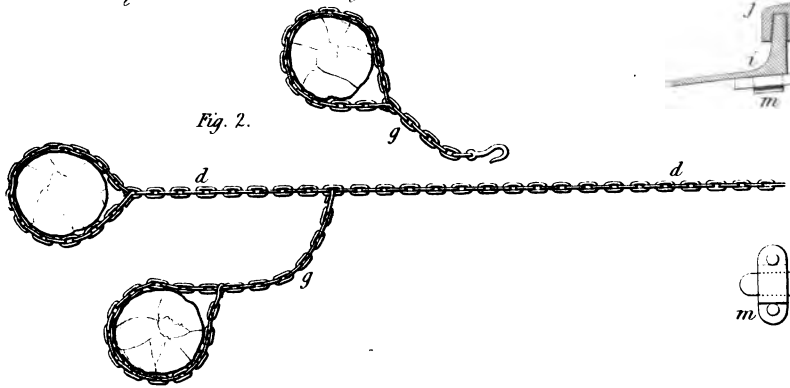


Plate

Mr Colin Shakespeare's Poems 1.


Mr. A. Aingers design for
Centering to large stone Arches.
Fig. 1.
Nº 1.
Fig. 2.
Fig. 3.
Fig. 4.
Scale of Feet to Fig. 1

Mr. McKay's mode of eradicating the stumps of Trees.



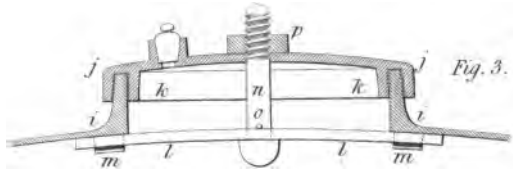
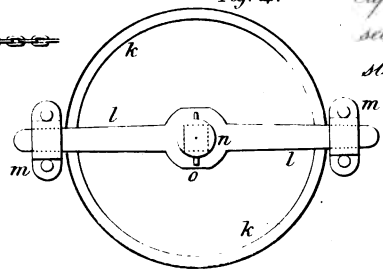
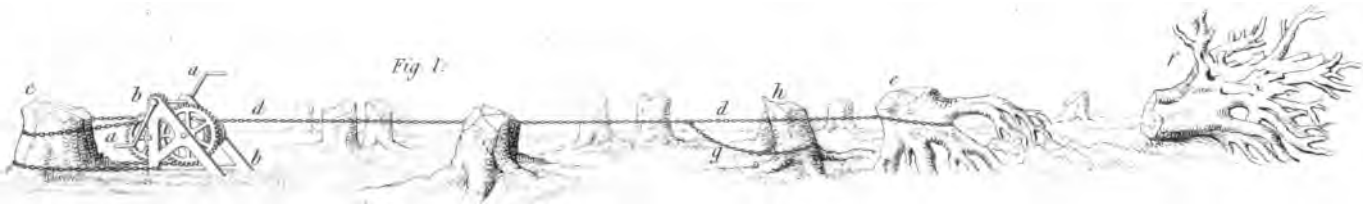


Fig. 3.

Fig. 4.



Capt. Bagnold's mode of securing the cover of a steam culinary boiler.



Engraved by W. Kelsall.

General Specimen
Promise to pay the Bearer on
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No. London 18 No.
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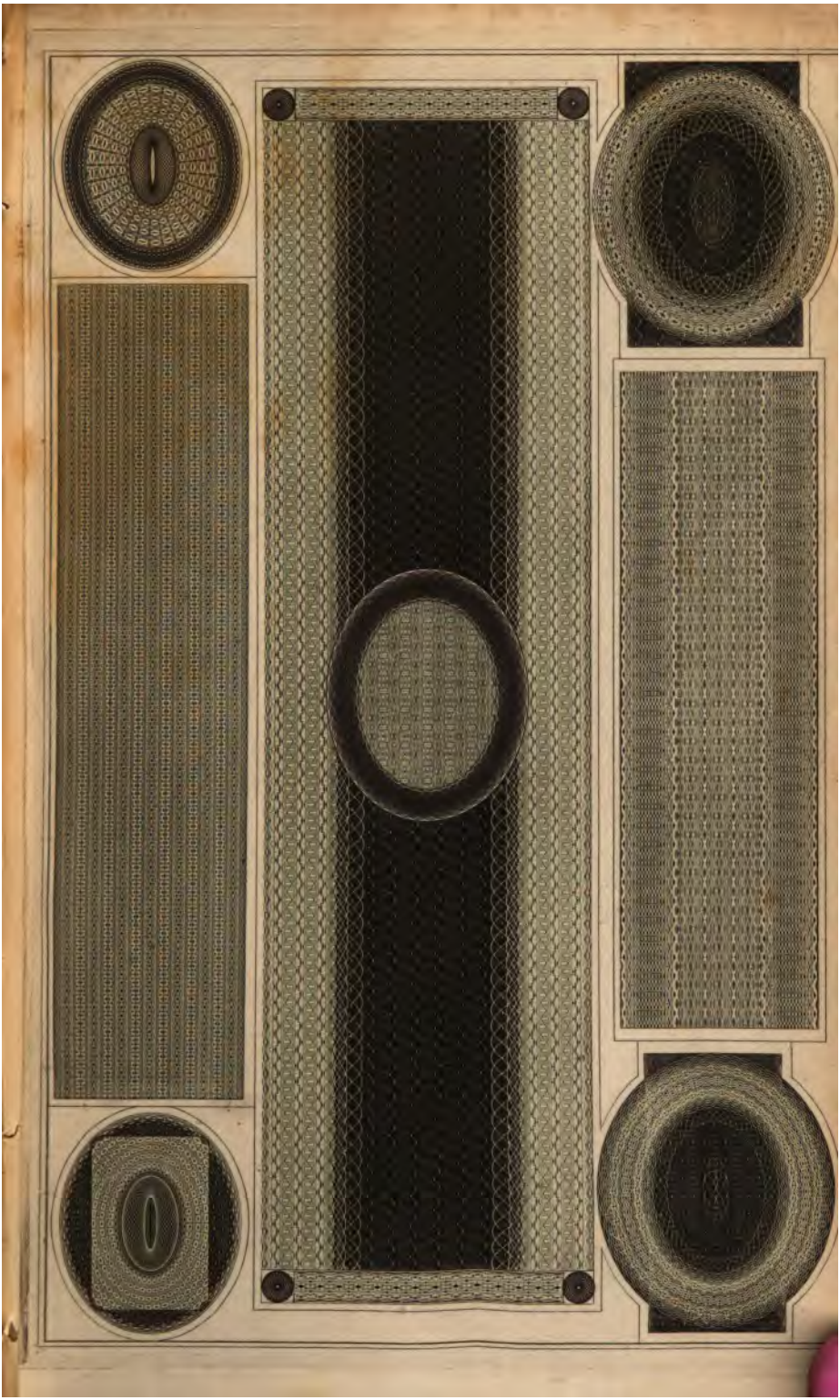

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ERRATA ET CORRIGENDA

IN VOL. XLII.

Title Page, *for* 1823 *read* 1824.
Preface, *page* xxviii, *bottom line*, *dele* and moon for.
Page 23, *line* 8, *for* on *read* for.
—— 36, — 6 *from bottom*, *after* register, *add m*, fig. 2.
—— 40, — 7 *from bottom*, *for* settlemens, *read* settlements.
—— 61, — 3 *from bottom*, *for* consists, *read* principally consists.
—— 61, — 2 *from bottom*, *for* impressions, *read* casts.
—— 83, — 7 *from bottom*, *for* the purposes, *insert* several purposes, *and omit the following words as far as* moulding plane *inclusive*.
—— 92, — 4 *from bottom*, *for* the lid of the strainer *f*, *read* the strainer, of which *f* is the lid.
—— 98, — 8, *for m read n*.
—— 98, — 10, *for* fixed, *read* fired.
In Plate VII. describing Lieut. Green's apparatus, it will be observed, that the front wheels of the carriages are smaller than the hind ones, although the former support the greater part of the weight. This otherwise improper arrangement is rendered necessary, by the recent introduction in ship building of a piece of timber at the angle formed by the deck and side of the vessel, called the water-way piece (which is not shown in the plate), and which, if the front wheels of the carriage were of the usual size, would prevent the muzzle of the gun from being projected far enough to obtain a sufficient lateral range.
In plate VII. fig. 5, the ends of the axle are by mistake represented square instead of round.
—— 120, — 8, *after b c add* fig. 3.
—— 122, *add to the description of Mr. Watt's Wrench*, that the chap *k* is prevented from receding by the circumstance, that the wedges *l l* and *m n* are together thicker at *m* than at *n*, which prevents their moving backwards, either together or separately, by a force applied at *k*.
—— 126, — 14, *dele* The tumblers are on Chubb's principle, without the detector; and,
In Plate XIV. figs. 2 and 3, the figures 1 2 3 4 5 6 7 and 8 should have been engraved in the reverse order.
—— 144, — 11, *for g read* 8.
—— 145, — 6 *from bottom*, *for* 6 *read* 7.
—— 147, — 18, *for* when the valve is shut, descends below the opening of the feed-pipe, and almost rests, &c. *read* descends below the bottom of the feed-pipe, and when the valve is shut almost rests, &c.
—— 150, — 15, *for* upright, *read* uprights.
12 *from bottom*, *for* plan, *read* elevation.
11 *from bottom*, *for* sectional elevation *read* horizontal section.
5 *from bottom*, *for* sectional elevation *read* horizontal section.
—— 151, — 3, *for* sectional elevation *read* horizontal section.
20, *for* transverse *read* longitudinal.
—— 164, — 3 *from bottom*, *after* wedges, read *v*, *v*.

TRANSACTIONS

OF

THE SOCIETY

OF

Arts, Manufactures, & Commerce.

VOL. XLIV.

TRANSACTIONS

OF THE

SOCIETY

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FOR THE

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WITH

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PREFACE.

THE present volume contains a description, more or less detailed, of the various inventions that, during the last session, have received the approbation of the Society. In offering these to the free use of the public, one great object of the Institution is fulfilled, at the same time that the non-resident members are hereby furnished with the means of forming some estimate of the activity of the Society, and of the judgment with which the funds placed at its disposal have been employed.

In the class of Agriculture and Rural Economy, the large silver medal has been given to Mr. Stickney, of Ridgmont, near Hull, for a variety of ray-grass. The Society have at various times bestowed rewards, both honorary and pecuniary, for ameliorating the pasture grounds of this country, either by the discovery and introduction of new species or varieties of grasses, or by the selection of the best

and most profitable of those which constitute the miscellaneous herbage of our natural meadows. Mr. Stickney's ray-grass is of the latter class; he has for several years cropped many acres with it, both alone and intermixed with clover; and the Society trust that they are benefitting the public, in recommending its use on soils similar to those on which it has been so profitably cultivated by Mr. Stickney.

The silver Ceres medal has been awarded to Mr. Milton, for a double bee-hive, with a revolving partition, whereby the bees may be commodiously excluded from the upper part previous to taking away the honey.

And the thanks of the Society have been voted to J. Smith, Esq., of Revel End, near St. Alban's, Chairman of the Committee of Manufactures, for the experiments made, and still making, by him, on a variety of autumn sown beans, for the introduction of which Mr. Taunton, a few years ago, received the Society's reward.

In the class of Chemistry, the large silver medal has been awarded to Mr. Abraham, of Sheffield, for

a new and ingenious mode of neutralizing or dispersing the magnetism which the balances of watches are sometimes found to possess, and which entirely destroys the truth of their going.

The silver Vulcan medal and ten guineas have been voted to Mr. Roberts, for his improved safe-lamp for miners. The only objection to the use of Sir H. Davy's safe-lamp is, that the wire gauze which incloses the flame obstructs a large proportion of the light. This inconvenience is greatly aggravated from the circumstance, that when the lamp is held very obliquely the oil flows out of its receptacle, smears over the surface of the gauze, and thus causes the smut and dust to adhere, till the interstices between the wire are more or less clogged up, and the light almost wholly obscured. To prevent this very serious inconvenience, Mr. Roberts has adapted a hemispherical cover to the oil vessel, which receives whatever may flow out of it when the lamp happens to be laid on its side.

In the class of Polite Arts, the sum of five guineas has been given to Mr. Cathery, for a new mode of executing ornamental work on ivory. Boxes and

other articles of ivory are often ornamented by designs in black, which contrast agreeably with the whiteness of the ground. This is effected by engraving the design with the usual tools, and then filling up the lines with black varnish; but the expense of this kind of work, if well done, is considerable, and the stiffness of the design so produced renders it of little value as a work of art. Mr. Cathery covers the surface of the ivory with engravers' varnish, then etches his design with the needle, and afterwards pours on a solution of nitrate of silver. Wherever this solution touches the ivory, an indelible black or brown stain is produced, without any sensible corrosion. The piece, therefore, will receive a perfect and even polish; the ornamental designs will be much freer and better as works of art; and at the same time a great saving of labour will be effected.

Mr. W. Cooke, Jun. and Mr. Humphrys, both engravers, have each had a gold Isis medal awarded to them for improvements in etching on steel plate. This material, when compared with copper, possesses the two great advantages of admitting finer work to be placed upon it, and of giving a much greater number of good impressions. The late Mr. Warren

was the first person whose endeavours to engrave on steel plate were sufficiently successful to attract the notice of his brother artists; and with the liberality which usually accompanies real genius, he communicated to the public, through the Society, of which he was a distinguished member, the results of his expensive and laborious investigations. Subsequently Messrs. Perkins and Heath, Mr. Lupton, and Mr. Turrell, communicated, through the same channel, a variety of extremely useful information on the preparation of the plate, the composition and mode of applying the varnish, and the various menstrua that may be used for biting-in after etching. The two artists who last year received the Society's rewards have also each of them communicated the successful results of their experiments, which will contribute to the farther progress of this as yet new art, and will, it is hoped, add another obligation on the part of the public, towards an institution from which all the information on this subject has hitherto emanated.

The silver Isis medal has been voted to Mr. Galpin, of Charmouth, for his very ingenious application of pulverised black-lead to the production of certain effects in pencil drawings, which can neither he ex-

pressed nearly so well in the usual way, nor with any thing like the same degree of expedition. Artists in this line will, for the future, feel themselves much obliged to this gentleman for the liberality with which he has made known to the Society all the particulars of his process.

The silver Isis medal has been voted to Mr. Tuson, modeller to the Horticultural Society, for his wax models of fruits and other vegetable productions. The unrivalled accuracy of the specimens, both in form and colour, and the permanency of this latter, it being unaffected by exposure to air, and by frequent handling, render such models the best and truest representations of their originals; and they no doubt will hereafter be appealed to as authority in disputed cases.

The large silver medal has been voted to Mr. Douglas Fox, of Derby, for his material for moulds. Clay, Paris plaster, and wax, are the materials employed in making moulds for plaster casts. The two former have no pliability; and the latter, though pliable, is not elastic. On this account, when the substance to be moulded is of a very uneven surface,

with undercut parts, as they are technically called, it is impossible to separate the mould from the original, except in many pieces; and where the orifice of a depression is narrower than its bottom, it is manifest that in such circumstances a mould can be only very imperfectly obtained. To join together, with accuracy, the numerous pieces of a complicated mould, requires much address, time, and experience, and it often fails in the hands of the best artists. Mr. Fox employs, as the material of his moulds, common glue, as thick as possible, consistent with the requisite degree of fluidity. In a short time it becomes solid, and being then divided into two or three pieces, parts readily from the most intricate and undercut surfaces, in consequence of its softness and elasticity. From such moulds casts may be obtained, in the usual way, of extreme delicacy and perfection.

It is now three years ago since the Society first began to offer premiums in this class, expressly for surgical students. They were induced so to do, in consequence of its being represented to them that many cases of diseased parts, or of malconformation, occur, which it would be highly interesting and instructive to preserve a record of, but which are lost

to the profession, because the practitioner in attendance is incapable of making a visible representation of appearances which no words can intelligibly describe. It was also considered desirable to endeavour to introduce into this country the art of modelling in coloured wax, the parts of the human body in their natural, morbid, or dissected states, the many advantages of which will be manifest to all conversant with such studies. The appeal of the Society to the junior members of the profession has not been made in vain. Mr. J. R. Alcock sent in a model in coloured wax, of a dissected arm, so well executed as to entitle him to the gold medal; the large silver medal was given to Mr. Jos. Towne, for a very beautiful small model of a skeleton.

In the class of manufactures, the Society voted their large silver medal to Miss Pether, for some samples of English silk produced the year before last. The worms were kept in a south room, but without any artificial heat, and up to the period of their last change of skin were fed solely with leaves of the cabbage lettuce. The quality of the silk, according to the testimony of the brokers and manufacturers to whom it has been shown, is superior to that of Ben-

gal, and equal to some kinds of Italian silk. If Miss Pether's success should induce any persons to make farther trials, on a larger scale, the Society recommend them to select, for breeding, the moths produced from the largest and hardest cocoons of a full yellow or orange colour.

It is with great satisfaction that the Society observe the rapid improvement which has taken place in the manufacture of hats and bonnets of British Leghorn; and they think that they may fairly take some credit to themselves for the zealous and liberal encouragement which, for the last four years, they have bestowed on this subject. As a means of bettering the condition of a very numerous and deserving class, the labourers in husbandry, by offering a healthy, clean, and profitable employment to the female part of their families, this manufacture well merits the most effectual patronage of the British public; not such a kind of patronage as often induces benevolent persons to put up with inferior articles from charitable motives, but that rational encouragement which is not led away by a word, and is more attentive to the quality of the product than to the real or imposed name which it bears. Several thousand hats, of do-

mestic manufacture, have this spring been sold under the name of Italian, their quality being nowise inferior to the average samples from Leghorn. It is time, therefore, that the the ladies of England should now interpose their powerful authority, and allow henceforth no distinction in these articles except of quality.

The sum of ten guineas, the premium offered, has been awarded to Mr. Long, the master of Barham House of Industry; and bounties have been given to the following competitors for the same premium, in proportion to the merit of their respective productions; namely, to S. Manwaring, of Bennenden; to Frances Cobbing, of Bury St. Edmunds; to Mrs. Ingledon, of Aldborough. The premium of ten guineas for the best plat of British material and manufacture, has been awarded to Mr. J. Horne, of Kenninghall; and the sum of five guineas to Mrs. Lowrey, of Exeter, for a new article, namely, a hat made of double split straw. Finally, a large silver medal has been awarded to Messrs. Muir, of Greenock, for the great zeal with which they have largely engaged in the manufacture, and for the admirable quality of hats made by them from the straw of rye grown in

Orkney, and platted by the female population of those islands.

Of the articles rewarded in the class of Mechanics, the two first are for improvements in tools, a kind of claim to which the Society always turns a favourable ear. Improvements in these must consist either in a reduction of their cost, or in an increased precision or rapidity of working. Now, although the gain on the price of each individual instrument, or on each class of work done by it, be but small; yet if this be multiplied by the number of such instruments in use, and by the number of days in the year, the sum of advantage thus gained by the community will in many cases amount to a quantity far superior to that which is produced by more elaborate inventions.

The silver Vulcan medal has been awarded to Mr. Collett, for an ingenious and simple pair of sheers, by which the slips of tin plate, of which the tags of laces for boots and other purposes are made, are bent in the act of being cut off. Two steps in the manufacture of these articles, heretofore distinct, are thus combined into one.

The sum of five guineas was given to Mr. Hooper, for an improved builders' level. The inventor is employed in superintending the works at the new palace in St. James's Park; and finding that in high and exposed situations the common bricklayers' level is inconvenient, from its bulk and incorrect form, the plummet swinging with the wind, has avoided both these objections, by an adaptation of the spirit-level to this purpose.

The large silver medal was voted to Mr. C. Hartley, for a very ingenious and simple hand-rail sector. To determine the curve of a hand-rail, winding round a well staircase, so as to cut it out of the rough wood with the least possible waste of material, is a problem in practical geometry which few carpenters are equal to. Mr. Hartley has greatly simplified the business by the invention of a machine which supersedes the geometrical construction heretofore necessary, and has thus brought it within the reach of any intelligent workman possessed of the elements of calculation.

The gold Vulcan medal was given to Mr. W. Spencer, of the Royal Dock-yard at Chatham, for his

method of letting go an anchor, an improvement sanctioned by the order given for its general adoption in the navy, and enabling a most important and often very critical manœuvre to be performed with great speed and precision, and without incurring the hazard of injury to the persons employed in it.

Another naval improvement has been communicated by Mr. Carey, of Bristol, surveyor of shipping, for which the Society have bestowed their silver Vulcan medal, consisting in the adaptation of half sheaves to the dead eyes. The lateral ropes, or shrouds, which support the masts, and also form the rope-ladders, are brought up to their proper degree of tension by means of the blocks called dead eyes; the wear both on the ropes and blocks, on account of the angular edges of the holes in the blocks, is often very injurious, and may occur in circumstances when the mischief cannot easily be repaired. Mr. Carey has inserted a half sheave of lignum vitæ in each of these holes, by which the wear is greatly reduced.

The silver Vulcan medal was awarded to Mrs. Henry Goode, of Ryde, in the Isle of Wight, for her ingenious and simple blind for the circular heads of

windows. Every one must have witnessed the annoyance produced by the entrance of strong sunshine through the circular heads of the large windows in churches, courts of justice, and other places of public resort, and the awkward contrivances for blinds to these parts. Mrs. Goode's blind is simple in construction, is closed or extended with the greatest ease, is not seen except when in use, and interferes in no degree with the symmetry of the building.

The sum of thirty guineas was awarded to Mr. Skinner, for a model of a stage coach, which in combining safety, ease of draft, and accommodation to the passengers, appeared, by the testimony of professional coach-builders and wheelwrights, to deserve this mark of the Society's approbation. The same candidate has also had the sum of five guineas voted to him for a trap for vermin, whether rats, mice, or other quadrupeds. The novelty of this trap is, that it sets itself. The animal in tugging at the bait draws out the support of the floor, and is itself precipitated sideways into a chamber below; the floor rights itself again by means of a counterpoise, and the support of the floor returns to the place whence it had been drawn out by the animal.

The sum of fifteen guineas was voted to Mr. Joshua Jenour, jun. for his shot-cartridge. When a charge of shot leaves the muzzle of a gun, the impulse communicated by the explosion of the powder is opposed by the resistance of the air, and attraction of gravity; in consequence of which it comes to the ground, after describing a parabolic curve longer or shorter according to the force originally impressed on it; and from the commencement of the flight the grains of shot begin to diverge at a greater or less angle, in proportion to the deviation of their respective figures from a perfect sphere. Many attempts have been made, by inclosing shot in cartridges of paper, of linen, and other materials, to increase their range and diminish their divergence; but as yet with small effect, probably because the cartridge is ruptured almost immediately on its leaving the gun. Mr. Jenour constructs his cartridge of two semi-cylinders of thin copper, grooved like a screw externally. These, being applied to each other, are secured by means of a thread wound round, and fitting the groove of the screw. The shot is poured into the cylinder through a hole at one end, which is afterwards closed. Previous to dropping the cartridge into the gun, the end of the binding thread is loosened, the consequence of which is, that

as soon as the cartridge is discharged the thread begins to unwind; and, as soon as completely unwound, the two halves of the cylinder separate and fall to the ground, and the shot begins to disperse. It was ascertained by experiment, that a charge of powder which would carry a given quantity of shot fifty yards, would carry the same weight of shot inclosed in the cartridge, a hundred yards. The separation of the cartridge depends on the unwinding of the thread, and this is regulated by its length, and perhaps by other circumstances. Further observation and experiments will be necessary, to ensure the requisite degree of precision in this respect; but the novelty, ingenuity, and probable utility, have been considered as establishing a fair claim to the Society's reward.

The silver Vulcan medal has been given to Mr. J. Adcock, for an adjustable lever for closing swing doors.

The silver Vulcan medal and ten guineas have been voted to Mr. Towson, of Devonport, for his banking for chronometers. The intention of a banking is to limit the motion of the balance, when, from any concussion or shaking of the machine, this part, or the

spring with which it is connected, are liable to injury: this may be done by a stud or pin, which produces its effect by a sudden stop or impulse; or by a pressure on the spring, which limits the inordinate motion in a more gradual manner. Both these methods, however, are extremely liable to affect the rate of the clock, so that in some of the best timekeepers of modern construction the banking is wholly omitted: the machine, however, is hereby liable, not merely to have its rate of going affected, but to be seriously injured in its works by a violent shock. Mr. Towson's banking comes into action only when the balance oscillates to the amount of about a circle and three quarters; and as under these circumstances (even if there were no banking) the rate would be affected, Mr. Towson's invention only prevents farther mischief when the oscillation has already become inordinate.

The large silver medal has been voted to Mr. W. Palmer, for an improved slide and carriage to the engravers' ruling-machine, by which its accuracy is improved and its cost diminished; an invention of no small importance, when it is considered how largely ruled lines are now introduced into almost all kinds of engraving.

The sum of ten guineas has been awarded to Mr. J. Alderson, for an arcograph or instrument for describing arcs of large circles, the centres of which are not given. It will be found a very convenient instrument to architects and others who have occasion to make working drawings on a large scale.

The sum of five guineas has been voted to Mr. D. Magson, for a float valve and stand-pipe for water mains. The float valve answers the same purpose as the common ball-cock for cisterns; is less likely to get out of order, and from an equal orifice furnishes a more copious supply of water. It has been tried and approved by some water companies, and is advantageous both to the buyers and sellers of this necessary of life.

To Mr. G. Edwards, of Lynn, the gold Vulcan medal has been awarded for an ingenious levelling and surveying instrument. The perambulator measures longitudinal distances by the revolution of a wheel, the circumference of which is known, and a common watch train, with pointers indicating the number of revolutions. To a machine of this kind Mr. Edwards has connected a sliding bar, with uni-

versal joints, terminated by a tracing or dotting wheel, which describes, on a piece of paper placed below it, a straight line, bearing a certain known proportion to the distance passed over by the perambulating wheel. A heavy pendulum is connected, by means of a very ingenious parallel motion, with the tracing wheel, so as to give it a direction upwards or downwards, proportioned to the obliquity of the surface over which the wheels of the machine are passing. Thus the line described by the tracer shows by its length the distance travelled, and by its variation from a horizontal line the altitude and depression of all the points in that distance, compared with the point from which the machine started. An experiment was tried in presence of a committee of the Society, on ground previously levelled according to the usual mode, with a perfect coincidence between the two results.

Three medals have been awarded for improvements in surgical instruments. Such subjects are only capable of being duly appreciated by professional men; and the Society in these, as in all similar cases, have been guided by the written certificates and oral testimony of those, both in and out of the Society,

who are best qualified on such subjects to direct their decisions.

The medals alluded to are the large silver medal to Mr. Fay, for his instruments for the use of dentists; the gold Vulcan medal to Mr. Holmes, for his craniotomy forceps; and the silver Vulcan medal to Mr. Clark, for his cupping glasses.

In the practice of veterinary surgery, injuries, often very serious, sometimes fatal, are experienced by horses, from the method of casting or throwing them on the ground preparatory to an operation. The stooping and constrained posture in which the surgeon is consequently obliged to place himself, added to the consciousness of the hazard which he is running of personal injury from the violent struggles of a powerful animal when in great pain, naturally render the performance of such operations less complete than they would be under circumstances more favourable to the address and self-possession of the surgeon. Mr. Goodwin, clerk of the stables to his majesty, and of large personal experience in veterinary practice, has invented a table, to which a horse may be secured without injury to himself, or the risk of injury to the

operator, which is very manageable, considering its bulk, and, with some simplification of the apparatus, will probably be found of great advantage. The Society have awarded to this gentleman their gold Vulcan medal.

The silver Vulcan medal and five guineas have been awarded to Mr. S. Williams, for his drag for raising drowned bodies. Submersion for a very few minutes is in almost all cases fatal; and the cumberousness of most drags is such, that life is irrevocably past away before they can be put in operation. The great lightness and portability of Mr. Williams's apparatus were the motives that induced the Society to recommend it to the public.

To diminish the hazard of life or limb which attends many occupations, has always been an object of much solicitude with the Society; and of these the business of dry grinding, as performed on needles, card wires, and many articles of cutlery, is perhaps the most unhealthy that is carried on. The particles of dust and of steel fill the grinding rooms with a dense cloud, which, being inhaled, occasions irritation of the lungs, and terminates in asthma or consump-

tion. For an effectual mode of preventing the dust from annoying the workmen the Society offered their large gold medal. This has been claimed by Mr. Cowen, of Carlisle, for his machine for card grinding, which, from inspection of the model, and from very satisfactory testimonials of its complete success in practice, seems to leave nothing further to be required.

In the class of Colonies and Trade—the gold Ceres medal was awarded to M. Barbe, of the Mauritius, for importing seventy-six tons of cocoa-nut oil.

It is now some years since the attention of the Society was drawn to the oil of the cocoa-nut, from the abundance in which it may be procured in almost all our intertropical colonies and possessions. Besides recommending it to the investigation of the public, there was inserted in the 34th volume of the Transactions a description and engraving of a hydrostatic press, adapted by Mr. Bramah to the expression of this oil. The subsequent discovery, that the whitest of all artificial flames is produced in the combustion of gas from the cocoa-nut oil, induced the Society to offer a gold medal for the importa-

tion of a certain quantity of it from any British colony.

It had been observed, that in many cases leakage to the amount of twenty and even thirty per cent. had occurred from casks of cocoa-nut oil, to the great detriment of the shipper, and to the serious injury of other articles, especially sugars, contained in the hold of the same vessel. Mr. Huxham, of Travancore, has shown how this may be, for the most part, avoided by a careful attention to the cooperage of the cask, after they have been filled. The thanks of the Society have been voted to this gentleman, and his communication is inserted in the present volume.

James Henderson, Esq. his majesty's consul general in the state of Columbia, has sent to the Society a box of the bark of a species of Cinchona, very abundant in the neighbourhood of Pitayo. This, on examination (at the request of the Society) by Mr. H. Hennell, one of the members, and superintendant of the laboratory at Apothecaries' Hall, appears to be richer in Quinia than the bark in common use, and will probably become an article of considerable commercial importance.

The Society have also received a number of articles from South America, collected and presented by the Rev. James Thomson. A descriptive catalogue of them is inserted in the present volume; and such of the articles as deserve it will probably receive a more detailed examination in the course of the present session. Some time ago a few bottles of liquid lacquer, from the Burman country, were sent to the Society by H. T. Colebrooke, Esq. which that gentleman had received from Dr. Carey, of Serampore. From the experiments made on this substance, by direction of the Society, it appears to be very doubtful how far it is capable of being advantageously used by English artists. It has, however, been thought proper that the information obtained on this matter should be communicated to the public.

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OFFERED IN THE SESSION

1826—1827.

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ADVERTISEMENT TO THE PUBLIC.

THE chief object of the Society is to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for the communication to the Society, and through the Society to the public, of all such useful Inventions, Discoveries, and Improvements, (whether specified in these premiums or not), as tend to that purpose: in pursuance of this plan, the Society have already expended upwards of a *Hundred Thousand Pounds*, derived from voluntary subscriptions and legacies.

The meetings of the Society are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The committees meet on other evenings in the week during the session, for the purpose of taking into consideration the subjects referred to them by the Society. A person desirous of becoming a member of the Society, may be proposed according to the following form, which must be signed by three members of the Society, and delivered in to the Secretary:

A. B. [*Trade, profession, or designation of the candidate.*] proposed as a Member of the Society for the Encouragement of Arts, Manufactures, and Commerce, by
C. D.
E. F.
[*Date.*] G. H.

Peers of the realm, or lords of parliament, are, on their being proposed, immediately ballotted for; the names of other persons proposed to become members are read by the secretary to the Society, and are then inserted in lists which are hung up in the Society's room; they are ballotted for at the second following ordinary meeting. In both cases, if two-thirds of the members then voting ballot in their favour, they are deemed perpetual members upon payment of not less than twenty guineas in one sum, or subscribing members upon payment of any sum not less than two guineas annually.

Ladies are eligible as members of the Society, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a member, on his producing a written authority for the same.

Members are entitled to vote and assist in all the business of the Society and of the several committees. They have also the privilege of recommending two persons as visitors at the meetings of the Society; and, by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various models, machines, and productions, in different

branches of arts, manufactures, and commerce, for which rewards have been bestowed; also to inspect the magnificent series of moral and historical paintings, executed by the late J. Barry, Esq. which, with some valuable busts, statues, portraits, &c. decorate the public rooms of the Society.

Members have the use of the Society's library, which is valuable, and annually increasing by the purchase and donation of scientific and useful books, and of engravings. Contributions from members and others, in augmentation of the library, and of the collection of maps and prints, will be thankfully received, and duly acknowledged in the annual volume of the Society's Transactions, to a copy of which every member is entitled.

☞ To persons inclined to leave a sum of money to this Society by will, the following form is offered for that purpose:

> ITEM.—I give and bequeath to A. B. and C. D. the sum of upon condition, and to the intent that they, or one of them, do pay the same to the collector, for the time being, of a Society in London, who now call themselves *the Society for the Encouragement of Arts, Manufactures, and Commerce;* which said sum of I will and desire may be paid out of my personal estate, and applied towards carrying on the laudable designs of the Society.

The Society desire it to be clearly understood, that, as a body, they are not responsible for any opinion or representation of facts contained in their volumes. And the public are requested to guard against imposition from persons advertising as having patents for articles rewarded by the Society; they are also cautioned against purchasing articles sold under the pretended sanction of the Society's name.

The Society have lately published the 43d *volume* of their Transactions, which may be had by members, on application to the housekeeper. Complete *sets* of their *Transactions*, or any single volume, may be purchased at the Society's house; where may be had also,

An *Analytical Index of the first twenty-five volumes* of the Transactions to the termination of the session, June, 1807, price 1*s*.

Ditto continued to the end of the 40th volume, price 1*s*.

A catalogue of books in the Society's library.

A description of Mr. Barry's paintings in the great room of the Society, *gratis*.

All communications are to be made by letter, addressed to *Arthur Aikin*, Esq. the secretary, at the Society of Arts, &c. Adelphi, London; and, where articles are sent by sea for the Society, the bills of lading are to be addressed to the care of *William Vaughan*, Esq. 70, Fenchurch-street, London, who has undertaken to receive them for the Society.

GENERAL NOTICE TO CANDIDATES.

The great object of the Society in rewarding individuals, is to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large. Candidates are, therefore, requested to observe, that if the means by which the respective objects are effected require an expense or trouble too great for general purposes, the Society will not consider themselves bound to give the offered reward; but though they expressly reserve the power, in all cases, of giving such part only of any premium as the performance shall be adjudged to deserve, or of witholding the whole if there be no merit, yet the candidates may be assured the Society will always judge liberally of their several claims.

The Society by no means restrict their liberality to the subjects for which premiums are specially offered, but will take into consideration, and will reward by a bounty proportioned to its merit, any communication, the subject of which is of a practical nature, and calculated to promote the public good.

All communications are to be made by letter, addressed to the secretary; and are to contain full and particular details, according to the nature of the subject, as well as accurate descriptions of such drawings and models as form part of the communication: the models to be sent *carriage paid.*

In those cases in which certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in tho words of the conditions attached to the respective premiums, and be signed by disinterested persons, who have a positive knowledge of the facts stated.

The premiums are designed for the United Kingdom, unless expressly mentioned to the contrary: but no claim will be attended to unless the previous conditions have been fully complied with.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained any premium or reward from any other society, or for which he has obtained, or purposes to obtain a patent: it being a condition stipulated with every candidate, that all articles rewarded by the Society shall be freely given up to the public, to be made or manufactured by any person whatever.

All models, the production of which is attached as a condition to any premium, shall, upon the delivery of such premium, remain the property of the Society.

Where premiums or bounties are obtained in consequence of specimens produced, the Society will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No member of this Society shall be a candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medals of the Society.

No candidate, not a member, shall be present at any meeting of the Society or committees, or be admitted at the Society's rooms, after having delivered in his claims, until such claims are adjudged, unless summoned by the committee.

A candidate for a premium, or a person applying for a bounty, being detected in any attempt to impose on the Society, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

The consideration of the claims for the premiums offered in the present list will take place during the session of the Society commencing on Wednesday the first of November, 1826. The several candidates and claimants, to whom the Society shall adjudge premiums or bounties, are to attend on the last Wednesday in May, or such other day as the Society shall appoint to receive the same; and before that time no premium or bounty will be delivered, except to those who are about to leave the kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, deputies may be substituted to receive the rewards, provided such deputies are either members of the Society, or superior officers thereof.

PREMIUMS IN AGRICULTURE.

INCLUDING

PLANTING, GARDENING, AND RURAL ECONOMY.

N. B. The Imperial bushel is the measure referred to for grain; and, as the acres of different districts vary in extent, it is necessary to observe, that the Society mean statute acres of five and a half yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.

Communications in claim of the following Premiums are required to be sent in to the Society (post paid) on or before the second Tuesday in February, 1827.

I.—IMPROVEMENT OF LAND.

Gaining Land from the Sea.

1. For the greatest quantity of land gained from the sea, not less than 100 acres, on the coast of Great Britain or Ireland;—*the Gold Medal.*

Certificates to be produced to the Society of the quantity of land, and that the experiments were begun after the 1st of January, 1821.

Improving Waste Land.

2. For a method, superior to any hitherto practised, of improving land lying waste and uncultivated, verified by practise on not less than fifty acres of land;—*the Gold Medal.*

3. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required that the land, before such improvement, be absolutely uncultivated, and in a great measure useless; and that, in its improved state, it be inclosed and cultivated.

Certificates to be produced to the Society, of the number of acres, of the quality of the land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof.

Laying down light Land to Permanent Grass.

4. For the most useful practical information respecting laying down light land to permanent grass, with a view to obtain a good sward in the shortest time;—*the Gold Ceres Medal.*

It is required that a full description be given of the qualities of the soil, its treatment for two years previous to being laid down, together with the cost of each operation, and certificates that at least two acres have been so laid down.

Salt as a Manure.

5. For the best account (verified by actual experiments) of the use of salt as a manure;—*the Gold Ceres Medal.*

II.—RAISING TREES, OR MAKING PLANTATIONS.

Forest Trees.

6. For having enclosed and planted or set between the 1st of October, 1822, and the 1st of April, 1823, the greatest number of acres (not less than one hundred) of land unfit for tillage, with forest trees, intended to stand for timber;—*the Gold Medal.*

7. For the next greatest quantity of land, not less than fifty acres;—*the Silver Medal.*

A particular account to be delivered to the Society of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after making the plantations.

Oaks, not transplanted.

8. For having set, in the season 1820-1821, the greatest quantity of land, not less than twenty acres, with acorns, and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

9. For the next greatest quantity of land, not less than ten acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, to be delivered to the Society, and that there are not fewer than 300 young oaks, in good condition, on each acre.

Larch.

10. For having planted out, between June, 1823, and June, 1824, the greatest number of larch trees, not fewer than fifty thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

11. For the next greatest number, not fewer than thirty thousand;—*the Silver Medal.*

Certificates to be delivered to the Society of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation.

N. B. The larch trees may be planted either mixed with other trees or by themselves, as may best suit the convenience of the planter.

Norway Fir.

12. For having raised, in the year 1825, the greatest number of plants from seed of Norway fir, imported from Norway;—*the Gold Medal.*

Certificates of the number of plants in a thriving state, not fewer than 3000, to be produced to the Society, accompanied by a full description of the methods followed in making the plantation, the expense of the same, the nature of the soil, and the district in Norway from which the seed was imported.

13. For having imported from Norway the greatest number, not less than two thousand, of Norway fir seedlings, and having planted the same during the year 1823, placing them at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates to be delivered in to the Society of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation.

N. B. It is recommended to plant seedlings of about three or four years' growth, and in a moderately good soil, somewhat sheltered. The wood from the district of Christiana is esteemed the best for carpenters' and joiners' use; and for spars and ufers the trees near to Long Sound are most valued.

Walnut Trees.

14. For having planted the greatest number of walnut trees, not less than two hundred, since June, 1824; and for having effectually fenced and preserved the same in order to raise timber;—*the Gold Medal.*

15. For the next greatest number, not fewer than one hundred;—*the Silver Medal.*

Certificates to be delivered in to the Society of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants from each other.

Mulberry Trees.

16. For having planted the greatest number of white mulberry trees, not less than one thousand, in the seasons 1824-5, and having effectually fenced the same;—*the Gold Ceres Medal.*

Certificates to be delivered in to the Society of having planted agreeably to the above conditions, the distance of the trees from each other, the nature of the soil and other particulars of management, whether the trees have been found to be affected by blights or by insects, and the state of the trees at the time of making the communication.

Securing Plantations.

17. For an account, founded on experience, and attested by proper certificates, of the most effectual and least expensive method, better than any other generally known, of securing young plantations of timber trees, and hedge-rows, from hares and rabbits, as well as from sheep and cattle ;—*the Gold Ceres Medal, or Thirty Guineas.*

Oaks.

18. For experiments continued for five years at least, on the comparative merits of the different modes of raising oaks for timber, from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on smooth surface, or among bushes, fern, or other cover; and from young plants raised in nurseries, and transplanted; regard being had to the expense, growth, and other respective advantages of the several methods ;—*the Gold Medal.*

Certificates to be produced to the Society that not less than one acre has been cultivated in each mode.

Walnuts.

19. For an improved mode of propagating the superior varieties of walnuts, either by budding, grafting, or any other mode, except sowing ;—*the Gold Medal.*

Certificates to be produced to the Society that not fewer than 50 trees have been so raised, with a full account of the method practised.

III.—CULTIVATION OF CORN AND OTHER PLANTS.

Wheat.

20. For the best set of experiments made on not less than twelve acres, four acres being sown broadcast, four drilled, and four dibbled, in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation, and the expense of each mode of culture, be fully described; and that proper certificates be produced to the Society of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw.

Ray Grass.

21. For a specimen of perennial ray grass (lolium perenne), being from stock originally of the candidate's own selection, which shall possess the properties of coming to a sward in less time than the varieties hitherto cultivated; and which shall be permanent, more abundant, of better quality, and as early as the most forward of the varieties usually sown ;—*the Silver Medal.*

It is required that five pounds of the seed, and a specimen of an entire plant of the grass, be forwarded with the communication, together with Certificates, of the candidate having cultivated the variety produced not less than six years, of his having, at the time of making the communication, at least ten acres sown with it, and of its superiority over other varieties of the same species.

Seed of Ticklemoth, or New England Grass.

22. For the greatest quantity of seed, not less than one hundred weight, from plants raised in Great Britain, of a species of Poa, a native of Connecticut in the United States, the stems of which are employed there as the material for fine plat, as described in the 40th volume of the Society's Transactions, and seeds of which have been imported and distributed by the Society ;—*the Silver Medal, or Twenty Guineas.*

23. For the next greatest quantity, not less than five pounds, by

persons not having previously obtained the Society's premium for this subject;—*the Silver Ceres Medal, or Ten Guineas.*

Satisfactory certificates, with a sample of the seed, and of the grass from which it was produced, to be sent to the Society.

N. B. This grass will probably make good meadow or pasture, as it is very hardy, and produces abundant herbage.

Cultivation of New England Grass.

24. For cultivating the greatest quantity of the above grass, not less than one acre, and experiments on its value as meadow or pasture, attested by proper certificates;—*the Gold Ceres Medal.*

Italian culture and treatment of Straw for Leghorn Plat.

25. For a full account of the methods of cultivating and treating the straw in Italy, for the manufacture of Leghorn plat, together with specimens of the straw;—*the Gold Ceres Medal, or Thirty Guineas.*

Beans.

26. For discovering and cultivating for two successive years, a species of horse-beans, or tick-beans, which, being sown in the spring, will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that the experiment shall have been made each year on not less than five acres of land, that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per bushel, and a sample of not less than a peck, be produced to the Society. It is apprehended that if a bean should be brought into cultivation with the habits of hotspur or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmer to till the land for the subsequent crop of wheat.

Preventing the rotting of Clover Plants.

27. For a method successfully employed in preventing the failure of clover crops, in consequence of the plants rotting on the ground, in the winter and spring, which they commonly do in patches, appearing to extend from a centre;—*the Gold Ceres Medal.*

Full particulars, and satisfactory certificates to be produced to the Society.

The Society invite persons to communicate any information on this subject which may tend to discover the cause of the clover plant rotting, although they may not be able to point out an effectual mode of preventing the same.

Cultivation of the White Poppy (papaver somniferum), and extraction of the Opium.

28. For the greatest quantity of opium, not less than 250 lbs., prepared from the white poppy (papaver somniferum), raised by the claimant, in the year 1826;—*the Gold Medal.*

29. For the next greatest quantity, not less than 120 lbs. the claimant not having previously obtained the Society's premium;—*the Gold Ceres Medal.*

Certificates to be sent to the Society of the quantity and quality of the produce, with specimens, and a full description of the mode of culture, and of the extraction and preparation of the opium.

Persons proposing to claim the above premiums, are referred to Mr. Young's communications on the subject, in the 37th and 38th volumes of the Society's Transactions; to those by Messrs. Cowley and Staines, in the 40th, 41st, and 42nd volumes; and to one by Mr. Jeston, in the 41st volume.

Cultivation of the Phormium Tenax, or New Zealand Flax.

30. For planting the greatest quantity of land, not less than one acre, with the phormium tenax, or New Zealand flax;—*the Gold Ceres Medal, or Thirty Guineas.*

A full account to be produced to the Society of the soil and exposure, the

mode of cultivation, the distance between the plants, at least a dozen of the longest leaves, with certificates that the plants have stood three winters in the open air.

The plant is perennial, is propagated by off-sets, and the flax is prepared from the fibres of the leaves. It has been cultivated as an ornamental plant in the open air, for several years, in the vicinity of Dublin, and in various parts of the south of Ireland; also in South Wales, and in Devonshire. For a farther account of it, see Mr. Salisbury's communication in the 42nd volume of the Society's Transactions.

Preserving Cabbages.

31. For the best and cheapest method of preserving drum-headed cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle, during the months of February, March, and April;—*the Silver Medal.*

A full and accurate account to be produced to the Society of the method employed, and of the expense, together with certificates that the produce of four acres has been so preserved, and applied to feeding sheep or cattle.

Harvesting Corn in wet Seasons.

32. For the best and cheapest method, superior to any hitherto practised, of harvesting corn in wet seasons;—*the Gold Medal.*

A full account to be produced to the Society of the method employed, and of the expense attending the process, with not less than two quarts of the corn, and certificates that, at the least, the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the sample.

Preserving Seeds during long Voyages.

33. For the best method of preserving the seeds of plants during long voyages, in a state fit for vegetation, the same being better than the methods now in use, and founded on actual experiment;—*the Gold Medal, or Thirty Guineas.*

IV.—DESTROYING INSECTS AND OTHER VERMIN.

Destroying the Grub of the Cock-Chafer, &c.

34. For an effectual method, verified by repeated and satisfactory trials, and attested by proper certificates, of destroying the grub of the cock-chafer, the wire-worm, or the slug, or of preventing or checking their destructive ravages on corn, peas, beans, and turnips;—*the Gold Medal.*

Destroying the Fly on Hops.

35. For an easy and efficacious method of destroying the fly on hops, superior to any hitherto known;—*the Gold Medal.*

Accounts and certificates to be delivered to the Society of the method having been successfully practised on not less than four acres of hop-ground.

Destroying the Fly on Turnips.

36. For an easy and efficacious method of destroying the fly on turnips, or of preventing its injurious effect on the crop;—*the Gold Medal.*

Conditions the same as for the preceding.

Preventing the blight on Fruit Trees and Culinary Plants.

37. For a method of preventing the blight, or ravages of insects, on fruit trees and culinary plants, superior to any hitherto known or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

V.—CATTLE AND SHEEP.

Use of Salt in feeding Cattle, &c.

38. For the best series of experiments, attested by proper certificates, respecting the use of salt in feeding cattle or preserving hay;—*the Gold Ceres Medal.*

Fatting Cattle.

39. For the best experiments on the comparative value of mangel-wurzel and Swedish turnips for fatting cattle, ascertained by feeding not less than three head of cattle upon each kind of food; —*the Gold Ceres Medal.*

A particular account is required, of the weight of each kind of root consumed; also whether any, and what, other kind of food has been given, together with certificates as to the condition of the cattle at the commencement and termination of the experiment.

Milch Cows.

40. For the most satisfactory experiments on the comparative value of mangel-wurzel and Swedish turnips for feeding milch cows, ascertained by keeping not less than three cows on each kind of food;—*the Gold Ceres Medal.*

A particular account is required, with certificates of the weight of each kind of root consumed, also whether any, and what, other kind of food has been given, as well as of the quantity and quality of the milk obtained, of the proportion of cream from a given quantity of the milk, and of butter from a given quantity of the cream.

Protecting Sheep.

41. For the best and cheapest method of protecting large flocks of sheep, not less than five hundred, from the inclemency of the weather during the winter months, particularly in mountainous districts, where the practice of protecting sheep has not hitherto been adopted;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time, together with the general method of managing them.

Cachemire-shawl Goat.

42. For having kept in a healthy state, in any part of the United Kingdom, during the last three years preceding the first of February, 1827, the greatest number of Cachemire-shawl goats;—*the Gold Medal.*

Certificates to be produced to the Society, that at least five goats are in good health at the time of making the communication, together with full particulars of the method of treating them.

Cure of the Rot in Sheep.

43. For the best and most effectual method of curing the rot in sheep, verified by repeated and satisfactory experiments;—*the Gold Medal, or Fifty Guineas.*

It is expected that the candidate furnish accurate accounts of the symptoms and cure of the disease, attested by proper certificates.

Preventing the ill effects of Flies on Sheep.

44. For the most effectual method of protecting sheep from being disturbed and injured by flies; —*the Silver Medal, or Ten Guineas.*

It is required that the method be ascertained by repeated experiments, attested by certificates.

VI.--AGRICULTURAL MACHINES.

Irrigation of Land.

45. For the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land, superior to and cheaper than any other method now in use;—*the Gold Medal, or Fifty Guineas.*

A model, on a scale of one inch to a foot to be produced to the Society, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it is raised.

Paring Plough.

46. For a machine or plough, for the purpose of paring land preparatory to burning, superior to any hitherto known or in use for such purpose;—*the Silver Medal, or Twenty Guineas.*

The machine, to be produced to the Society, and certificates that at least ten acres have been pared by it in a proper manner.

Thrashing Machine.

47. For a machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at less expense than by any method now in use, and without injuring the straw more than thrashing by the flail;—*the Gold Medal.*

The machine, or model, to be produced to the Society, with proper certificates that such a machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation.

PREMIUMS IN CHEMISTRY, DYEING, AND MINERALOGY.

Claims for premiums in this Department are to be sent in on or before the first Tuesday in February, 1827.

Increasing Steam.

48. For a method, verified by actual experiment, of increasing the quantity or force of steam in steam engines, provided the risk of accidents be not increased, and the whole amount of the expenses be considerably lessened;—*the Gold Medal, or Fifty Guineas.*

Prevention of Smoke.

49. For a method superior to any now before the public, of preventing the emission of dense smoke, from the chimnies of steam engines, breweries, and manufactories;—*the Gold Medal, or Fifty Guineas.*

Certificates to be produced to the Society, that the means proposed have been found to succeed in practice.

Test for Arsenic.

50. For a test for arsenic in solution, superior to any hitherto known;—*the Gold Medal.*

Any communication in claim of this premium must include a method of detecting arsenic, not only in its usual form of white arsenic, or arsenious acid, but also in the state of arsenic acid, and of the soluble salts formed by the combination of arsenious and arsenic acids with alkaline substances.

Preventing the ill effects of Smelting Ores.

51. For the most effectual method of preventing the ill effects arising to vegetation and animal life, from the sulphureous arsenical or other noxious fumes disengaged in smelting the ores of copper, zinc, lead, tin, iron, &c. in the large way; and, if possible, of converting those pernicious fumes to useful purposes, in a manner superior to any hitherto known or in use;—*the Gold Medal, or Fifty Guineas.*

A full account of the process employed will be required, together with certificates of its having been successfully carried into effect.

Fine Bar-Iron.

52. To the person who shall make the greatest quantity of bar-iron, not less than ten tons, with coke, from coke pigs, equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal, or Fifty Guineas.*

Samples to be produced to the Society, not less than one quarter of a hundred weight, with certificates that the whole quantity is of equal quality.

Refining Copper from the Ore.

53. For a method of separating, purifying, and refining copper from the ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than, and superior to, any hitherto known or in use;—*the Gold Medal, or Fifty Guineas.*

Certificates to be produced to the Society that not less than three tons have been so prepared and refined, and a quantity of not less than 14 lbs. of the copper so refined.

Refining Zinc from the Ore.

54. For refining zinc from the ore, by a process superior to any hitherto known or in use, and rendering it fit for the purpose of making fine brass;—*the Gold Medal, or Fifty Guineas.*

Conditions the same as in the preceding.

Preparing Brass.

55. For a method of making brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process to be produced to the Society, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured. and a sample of the brass, not less than 14 lbs.

Improved Earthenware Crucibles.

56. For manufacturing earthenware crucibles which shall not be liable to crack in the fire, and shall be capable of enduring the action of fluxes, and higher degrees of heat than those now in use, and shall not be too expensive;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process to be produced to the Society, and of the materials employed, with satisfactory certificates of the crucibles having been found to answer in use, and specimens of the crucibles, with covers of the same material.

Improved melting Pots.

57. For manufacturing melting pots, for founders in brass, iron, and other metals, superior to those now in use, and not too expensive;—*the Gold Vulcan Medal, or Thirty Guineas.*

Conditions the same as in the preceding premium.

Purifaction of Coal Gas.

58. For a method of purifying the inflammable gas procured from coal, superior to any now in use;—*the Gold Vulcan Medal, or Thirty Guineas.*

A full account of the process to be produced to the Society, with Certificates of its fully answering the intended purpose.

Refining Whale or Seal Oil.

59. For an effectual method of purifying whale or seal oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; provided that such purified oil resists congelation in an equal degree with the unpurified;—*the Gold Medal, or Fifty Guineas.*

A full account of the process to be produced to the Society, and certificates that not less than twenty gallons have been purified according to the process delivered

in, together with two gallons of the oil in its unpurified state, and two gallons so refined.

Oil for Chronometers.

60. For a method, verified by actual experiment, of rendering oil more fit than any now in use for chronometers and watches, particularly in being less liable to become thick or rancid;—*the Gold Medal, or Fifty Guineas.*

A full account of the experiments to be produced to the Society, and of the process employed, with satisfactory certificates, together with a specimen of the oil.

Crown Glass.

61. To the person who shall make crown or window glass equally transparent, and as free from blue and green colour, as the best German sheet;—*the Gold Vulcan Medal, or Thirty Guineas.*

Certificates to be produced to the Society, that not less than two cwt. have been made, together with one whole plate and two of the largest squares that can be cut, and a full account of the proportions of the ingredients, and of the process of manufacture.

Flint Glass.

62. To the person who shall make flint glass free from veins, as dense and transparent as the best now in use, and quite fit for the purposes of opticians;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, with certificates that not less than 20 lbs, have been made, and that object glasses, at least three and a half inches in diameter, have been manufactured of the same, together with specimens of the glass in its rough and manufactured state, to be produced to the Society.

Indelible Ink.

63. For a method of making a black writing ink, superior to any at present known, and indestructible by chemical applications;—*the Silver Medal, or Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, with a full detail of the process of making it, and two quarts of the ink, to be produced to the Society.

Printers' Ink.

64. For the best composition for printers' ink, superior to any hitherto in use;—*the Gold Medal, or Thirty Guineas.*

Certificates that 112 lbs. of such ink have been made, with a full account of the process employed, and 6lbs. of the ink to be produced to the Society.

Copper-plate Printers' Ink.

65. For the best composition for printers' ink, superior to any hitherto known, and fit for the finest kind of copper-plate printing;—*the Gold Medal, or Thirty Guineas.*

Certificates and conditions the same as for the last premium.

Rendering Leather Water-proof.

66. For a method, superior to any now in use, of rendering leather water-proof, without injuring its texture or pliability;—*the Silver Medal, or Fifteen Guineas.*

A full account of the process, with samples of the leather in its unprepared and prepared state, to be produced to the Society.

Preserving Seeds of Vegetables.

67. For a method, superior to any at present known, and verified by sufficient trials, of preserving seeds of plants, during a long sea voyage, in a state fit for vegetation;—*the Gold Medal, or Thirty Guineas.*

Preserving Provisions from becoming Rancid or Rusty.

68. For the best, cheapest, and most efficacious method, superior to any hitherto known, of preserving salted provisions from becoming rancid or rusty;—*the Gold Medal, or Thirty Guineas.*

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society.

69. For a method of curing or preserving meat, during long sea voyages, superior to any now in use;—*the Gold Vulcan Medal, or Thirty Guineas.*

Conditions the same as for the preceding premium.

Preserving Iron from Rust.

70. For a cheap composition, superior to any now in use, which shall effectually preserve wrought iron from rust;—*the Gold Medal, or Fifty Guineas.*

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, with one pound weight of the composition, to be produced to the Society.

Preventing the Dry Rot in Timber.

71. For a certain method of preventing the dry rot in timber, superior to any hitherto known;—*the Gold Medal, or Fifty Guineas.*

The particulars of the method of prevention, confirmed by repeated experiments, to be produced to the Society.

Preventing the Mildew in Paper or Canvas.

72. For a process to be used in the manufacture of paper or canvas, or some application to be made to manufactured paper or canvas, which shall effectually prevent it from becoming mildewed;—*the Gold Medal, or Fifty Guineas.*

A full account of the process employed, with certificates and other evidence of its efficacy, to be communicated to the Society.

Preventing the destructive Effects from Moths.

73. For a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal, or Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society.

Substitute for Lead Pipes.

74. For pipes for conveying malt and other liquors from the cellars to the bars of public-houses, superior to any now in use;—*the Gold Medal, or Fifty Guineas.*

The substance of which the pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and of a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society.

Dyeing Silk of a Pink or Rose Colour.

75. For a substitute for safflower in dyeing silk rose and pink, which shall produce a colour equally beautiful and permanent, and at less expense;—*the Gold Medal, or Forty Guineas.*

The communication, with a full account of the processes employed, and certificates, to be produced to the Society.

Improved Black Dye for Silk or Wool.

76. For a black dye for silk or wool, superior in colour and durability to any at present in use;—*the Gold Medal, or Fifty Guineas.*

A full account of the process, attested by satisfactory certificates, as well as samples of the silk or wool so dyed, to be produced to the Society.

Dyeing with Lac Lake, or with the Colouring Matter of Lac.

77. For a method of dying silk, wool, or cotton with lac lake, or with the colouring matter of lac,

superior to any now in use;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, with certificates that it has been found to answer completely in use, and specimens of articles so dyed, to be produced to the Society.

Preparation of a Red Stain for Cotton Cloth.

78. For a method of printing or staining cotton cloth with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal, or Fifty Guineas.*

An account of the process, with specimens to be produced to the Society.

Preparation of a Green Colour for Printing Cotton Cloth.

79. For the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions of indigo;—*the Gold Medal, or Fifty Guineas.*

Certificates and conditions as for premium 78.

Substitute for the basis of White Paint for Oil Colours.

80. For the best substitute, superior to any hitherto known, for the basis of white paint for oil colours, equally proper for the purpose as the white lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white lead;—*the Gold Medal, or Fifty Guineas.*

A quantity of the substitute, not less than 10 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society.

Permanent White Paint for the use of the Artists.

81. For a white paint for oil, superior to any hitherto known, and not liable to be discoloured by exposure to light, or to sulphuretted hydrogen gas;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, and ½ lb. of the colour, to be produced to the Society.

Red Pigment.

82. For a red pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal, or Fifty Guineas.*

Four ounces of such colour, and a full disclosure of its preparation, to be produced to the Society.

N. B. It is required that the colour should remain unaltered by common exposure to strong light, damps, and noxious vapours.

Blue Pigment.

83. For a blue pigment, equal in colour, brilliancy, and durability, to the best ultramarine prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal, or Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

Colourless Lac Varnish.

84. For a varnish made from shell or seed lac, equally hard and as fit for use in the arts as that at present prepared from the above substances, but deprived of its colouring matter;—*the Gold Medal, or Thirty Guineas.*

A full account of the process, and one quart of the varnish, to be produced to the Society.

Stone for Lithography.

85. To the person who shall discover within Great Britain or Ireland, a quarry of stone fit for the purposes of lithography, equal at least to the stones imported from abroad;—*the Gold Medal, or Fifty Guineas.*

A specimen of the stone, at least two feet square and two inches in thickness, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society.

Substitute for Stone for Lithography.

86. To the person who shall discover and communicate to the Society any substance equally fit for the purposes of lithography with the best stones imported from abroad;—*the Gold Isis Medal, or Thirty Guineas.*

A full description of the process of preparing or composing the substance, with specimens thereof, to be produced to the Society.

Mineralogical and Geological County Maps.

87. To the person who shall complete and publish the best mineralogical and geological map of any county in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced, with sections of the strata;—*the Gold Medal, or Fifty Guineas.*

The map, with certificates of its accuracy, to be produced to the Society. One impression of the map to remain the property of the Society.

Mineralogical and Geological Map of Ireland.

88. To the person who shall complete and publish an accurate mineralogical and geological map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal, or Fifty Guineas.*

The conditions are the same as in the preceding.

Mineralogical and Geological Map of Scotland.

89. The same premium is offered for a mineralogical and geological map of Scotland, on similar conditions.

PREMIUMS IN POLITE ARTS.

HONORARY PREMIUMS FOR NOBILITY.

To Gentlemen under the age of twenty-five, Sons or Grandsons of Peers or of Peeresses in their own right in the United Kingdom.

90. For the best original painting or drawing of an historical subject;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

91. For the best copy of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

92. For the best original painting or drawing of a portrait;—

the Gold Isis Medal. For the next in merit, *the Silver Medal.*

93. For the best copy of a portrait;—*the Silver Medal.* For next in merit, *the Silver Isis Medal.*

94. For the best original painting or drawing of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

95. For the best copy of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

96. For the best original painting of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

97. For the best copy of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

98. For the best original painting of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

99. For the best copy of still-life;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To LADIES *under the age of twenty-five, daughters or grand-daughters of Peers or Peeresses in their own right of the United Kingdom*

100. For the best original painting or drawing of an historical subject;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

101. For the best copy of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

102. For the best original painting or drawing of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

103. For the best copy of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

104. For the best original painting or drawing of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

105. For the best copy of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

106. For the best original painting of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

107. For the best copy of flowers or fruit;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

108. For the best original painting of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

109. For the best copy of still-life;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

HONORARY PREMIUMS FOR GENTLEMEN AND LADIES.

To GENTLEMEN *under the age of eighteen.*

110. For the best drawing in chalk, pencil, or Indian ink, being a copy from any picture, print, or drawing of a head or figure;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

111. For the best drawing in pencil, Indian ink, or chalk, of a landscape, being a copy;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

To Gentlemen *under the age of twenty.*

112. For the best drawing in chalk, pencil, or Indian ink, from a bust;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To Gentlemen *under the age of twenty-one.*

Drawings and Paintings in Water-Colours.

113. For the best drawing in chalk, pencil, or Indian ink, from a statue or cast in plaster, of an entire figure;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

114. For the best drawing in pencil, Indian ink, or chalk, of an historical subject, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

115. For the best painting in water-colours, of an historical subject, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

116. For the best painting in water-colours of a portrait, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

117. For the best painting in water-colours of a landscape, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

118. For the best painting in water-colours of flowers or fruit, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Paintings in Oil.

119. For the best copy in oil-colours of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

120. For the best copy in oil-colours of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

121. For the best copy in oil-colours of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

122. For the best copy in oil-colours of flowers or fruit;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To Gentlemen *under the age of twenty-five.*

Drawings and Paintings in Water-Colours.

123. For the best original painting in water-colours of an historical subject;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

124. For the best original painting in water-colours of a portrait, being a miniature;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

125. For the best original painting in water-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

126. For the best original painting in water-colours of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Paintings in Oil.

127. For the best original painting in oil-colours of an historical subject, consisting of not less than three figures;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

128. For the best original painting in oil-colours of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

129. For the best original painting in oil-colours of a landscape; —*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

130. For the best original painting in oil-colours of flowers or fruit;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

131. For the best original painting in oil-colours of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

To LADIES *under the age of eighteen.*

132. For the best drawing in pencil, Indian ink, or chalk, being a copy from any picture, print, or drawing, of a head or figure;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

133. For the best drawing in pencil, Indian ink, or chalk, of a landscape, being a copy;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

To LADIES *under the age of twenty.*

134. For the best drawing in pencil, Indian ink, or chalk, from a bust;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To LADIES *under the age of twenty-one.*

Drawings and Paintings in Water-Colours.

135. For the best drawing in pencil, Indian ink, or chalk, from a statue or cast in plaster, of an entire figure;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

136. For the best drawing in pencil, Indian ink, or chalk, being a copy, of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

137. For the best painting in water-colours, being a copy, of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

138. For the best painting in water-colours of a portrait, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

139. For the best painting in water-colours of a landscape, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

140. For the best painting in water-colours, being a copy, of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Paintings in Oil.

141. For the best copy in oil-colours of an historical subject;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

142. For the best copy in oil-colours of a portrait;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

143. For the best copy in oil-colours of a landscape;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

144. For the best copy in oil-colours of fruit or flowers;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

To Ladies under the age of twenty-five.

Drawings and Paintings in Water-Colours.

145. For the best original painting in water-colours of an historical subject;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

146. For the best painting of a portrait in water-colours, being a miniature;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

147. For the best original painting in water-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

148. For the best original painting in water-colours of fruit or flowers;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Paintings in Oil.

149. For the best original painting in oil-colours of an historical subject, consisting of not less than three figures;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

150. For the best original painting in oil-colours of a portrait;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

151. For the best original painting in oil-colours of a landscape;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

152. For the best original painting in oil-colours of fruit or flowers;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

153. For the best original painting in oil-colours of still-life;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

N.B. As the foregoing honorary premiums are intended only for the nobility and gentry, persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admitted candidates in the above classes.

PREMIUMS FOR ARTISTS AND OTHERS.

Human Figure.

154. For the best drawing in chalk, pencil, or Indian ink, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

155. For the best outline, drawn from any entire figure of the antique, or cast in plaster, the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under the age of eighteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

156. For the best drawing from any entire antique figure, or from any cast in plaster, the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

157. For the best outline drawing of an entire anatomical human figure, from a model or cast, the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot the size of life, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

158. For the best drawing from the living figure, the size of the drawing to be not less than twenty-four inches, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

159. For the best copy in water-colours from any picture, being a composition of two or more figures, the size of the principal figure not less than nine inches, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

160. For the best original drawing, being a composition of two or more figures, the principal figure not less than nine inches, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

161. For the best copy in oil from any picture, being a composition of two or more figures, the principal figure not less than twenty-four inches, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

162. For the best original painting in oil, being an historical composition, of not less than three figures, the principal figure not less than twenty-four inches high, and the size of the canvass to be a common half-length (or three feet four inches by four feet two inches); the subject *Samson and Dalilah,* "the Philistines are upon thee;" by persons under the age of twenty-five;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

163. For the best original painting in oil, being an historical or poetical composition, of not less than three figures, the principal figure not less than twenty-four inches high; the size of the canvass to be a common half-length (or three feet four inches by four feet two inches) by persons under the age of twenty-five;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Heads or Portraits.

164. For the best drawing of a head, copied from any picture, drawing, or print, by persons under the age of sixteen;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

165. For the best finished drawing of a head, not less than the size of life, from any bust, by persons under the age of eighteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

166. For the best painting in oil, from an antique bust or cast, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

167. For the best origiual painting in water-colours of a portrait, or group of portraits, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

168. For the best portrait in miniature, in water-colours, being a copy, by persons under the age of twenty;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

169. For the best original portrait in miniature, in water-colours, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

170. For the best copy in oil, of a portrait, by persons under the age of nineteen;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

171. For the best original painting in oil of a portrait, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Models.

172. For the best model in bass-relief, from any entire antique figure or cast in plaster, the size of the model not less than twenty-four inches, by persons under the age of eighteen ;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

173. For the best model in bass-relief, from the living figure, by persons under the age of twenty-one, the model not less than twenty-four inches ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

174. For the best model of a bust from the antique, of a different size from the original, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

175. For the best model of a bust from nature, of the size of life, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal,*

176. For the best model in the round, from an entire antique figure, the model not less than twenty-four inches high, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

177. For the best original model of a single figure, not less than twenty-four inches high, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

178. For the best original model of a group, the subject, *Perseus rescuing Andromeda,* the figures not less than twenty-four inches, by persons under the age of twenty-five ;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Landscape.

179. For the best drawing of a landscape, copied from any picture, drawing, or print, by persons under the age of eighteen ;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

180. For the best original drawing of a landscape from nature, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

181. For the best original oil painting of a landscape from nature, by persons under the age of twenty-three ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

182. For the best original composition of a landscape painted in oil, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

183. For the best original marine painting, in oil, of two or more vessels, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Flowers or Fruit.

184. For the best painting in water-colours, by persons under the age of sixteen ;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

185. For the best original composition in water-colours, from

nature, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

186. For the best original composition in oil, painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Animals.

187. For the best drawing of one or more animals, copied from any picture, print, or drawing, by persons under the age of sixteen; —*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

188. For the best original drawing from nature, of one or more animals, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

189. For the best original painting in oil, of a group of not less than three animals, painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Still-life.

190. For the best original composition, painted in oil, or water-colours, of three or more such subjects as are usually called still-life, by persons under the age of twenty-one;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Vignette.

191. For the best design for a vignette to be printed at the head of the Society's letters, &c;—*the Gold Medal.*

The design to remain the property of the Society.

Architecture.

Claims for the architectural premiums are to be sent in to the Society on or before the third Tuesday in January, 1827.

192. For the best drawing in perspective from a Corinthian capital, not less than eighteen inches high, by persons under twenty-one years of age;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

193. For the best drawing of an original composition of foliage or other ornament adapted to the decorative purposes of architecture;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

The drawing to remain the property of the Society.

194. For the best design for a Metropolitan University;—*the Gold Medallion.* For the next in merit, *the Silver Medal.*

The following inscription to be engraved on the medallion; "*The premium given by the Society for the encouragement of Arts, Manufactures, and Commerce, in conformity to the will of John Stock, Esq., of Hampstead.*"

The drawings sent in for this premium to consist of one or more plans, elevations, and perspective views, with separate representations of such parts as may be necessary to give a complete explanation of the design. The drawings to be made on a scale of one-eighth of an inch to a foot; the perspective view, and the particular parts, on a larger scale if necessary.

195. For the best design in Greek architecture of a building adapted to the purpose of a court of justice in the metropolis, to consist of plan, elevation, and perspective view, on a scale of one-eighth of an inch to a foot, by persons under the age of thirty; —*the Gold Isis Medal.*

196. For the best perspective drawing of any public building in the United Kingdom, from actual

elevations taken by measurement, and projected according to rule, drawn on large elephant paper, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Drawings of Machinery.

197. For the best perspective drawing of machinery, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Enamel Painting.

198. For the best enamel painting of a head, by persons under the age of twenty-three ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

199. For the best historical painting in enamel, by persons under the age of thirty;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Carving in Wood.

200. For the best carving in wood of fruit or flowers, not less than nine inches high, by persons under the age of twenty-one ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

201. For the best carving in wood, of one or more animals, the size of the animal not less than eight inches, by persons under the age of twenty-three ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

202. For the best carving in wood, of one or more human figures, not less than a foot in height, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

203. For the best carving in wood, of any enriched border or ornamental design ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

Etching.

204. For the best free etching in historical composition, by persons under the age of twenty ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

205. For the best free etching of a landscape, by persons under the age of twenty ;—*the Silver Isis Medal.* For the next in merit, *the Silver Palette.*

206. For the best free etching in historical composition, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

207. For the best free etching of a landscape, by persons under the age of twenty-five ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

Finished Engravings on Steel or Copper.

208. For the best finished engraving in historical composition, by persons under the age of twenty ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

209. For the best finished engraving of a landscape, by persons under the age of twenty ;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

210. For the best finished engraving in historical composition, by persons under the age of twenty-five ;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

211. For the best finished engraving of a landscape, by persons under the age of twenty-five ;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

212 For the best finished engraving of a portrait, by persons under the age of twenty-five;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

213, For the best finished engraving on steel, in mezzotinto;—*the Gold Isis Medal.*

N.B. In the class of finished engravings the Society require an aquafortis impression, and a finished proof, to be sent, and to remain with the Society.

Engraving on Blocks.

214. For the best engraving on wood or metal blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the block, to be produced to the Society. The impressions, but not the block, to remain the property of the Society.

Lithography.

215. For the best specimen in this art;—*the Gold Isis Medal.*

The specimen to remain the property of the Society.

216. For the best account of the process employed in lithography superior to any hitherto known to the public;—*the Gold Isis Medal, or Thirty Guineas.*

The particulars of the process, accompanied by specimens of the art, and of the materials employed, with all other necessary information, to be produced to the Society on or before the first Tuesday in March, 1827.

217. For the best method of transferring drawings from the paper to the stone, for the purpose of lithography, superior to any hitherto in use;—*the Silver Medal, or Twenty Guineas.*

A complete account of the process employed, with specimens of the materials, to be produced to the Society.—Two specimens of the impression to remain with the Society.

Medal Die Engravings.

218. For the best die engraving either of a head or single figure, after the engraver's own design or model, by persons under the age of twenty-one;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

219. For the best die engraving of a group, after the engraver's own design and model, by persons under the age of thirty;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

The dies with two impressions or casts, and the model, in each claim for medal die sinking, are to be produced to the Society, and the impressions or casts to remain the property of the Society.

220. To the person who shall discover and communicate to the Society a method of making and hardening medal dies, superior to any hitherto known, and which shall prevent the surface of the die from being cracked, scaled, warped, or otherwise injured;—*the Gold Medal, or Thirty Guineas.*

A full and detailed account of all the processes required to produce the effect, with certificates of their successful application, to be delivered to the Society.

Gem Engraving.

221. For the best engraving in intaglio, of a head or single figure, on carnelian or other hard stone, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

222. For the best engraving in intaglio of a head or figure, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

223. For the best engraving in intaglio of a group, after the engraver's own design and model, on carnelian or other hard stone;—

the Gold Medal. For the next in merit, *the Gold Isis Medal.*

224. For the best engraving in cameo of a head or single figure, on carnelian or other hard stone, being a copy;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

225. For the best engraving in cameo of a head or figure, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Isis Medal.* For the next in merit, *the Silver Medal.*

226. For the best engraving in cameo of a group, after the engraver's own design and model, on carnelian or other hard stone;—*the Gold Medal.* For the next in merit, *the Gold Isis Medal.*

Premiums for Medical or Surgical Students.

227. For the best coloured anatomical model of a dissected limb, or other part of the human body, in wax or other substance;—*the Gold Medal.*

228. For the best original drawing (made from actual dissection) of the anatomy of the human body, or of any part thereof, sufficiently full and accurate for the purposes of surgery, such drawing to be not less than the natural size of the parts, by persons under the age of twenty-five;—*the Silver Medal.* For the next in merit, *the Silver Isis Medal.*

It is required that each model and drawing be accompanied by an outline, with the necessary references to render them intelligible.

Conditions for the Polite Arts.

All performances in the class of Polite Arts, except those relating to architectural subjects, are to be produced to the Society on or before the first Tuesday in March, 1827, and none can be received after that day.

No candidate, under any pretence whatever, shall be allowed to retouch or varnish a performance after it has been received by the Society.

No candidate having received a premium or bounty, shall receive an equal reward in the same class or an inferior reward in any class of the same department of art. Nor shall any bounty be given lower than one degree below the lowest of the premiums offered in each class.

No more than one performance in each class shall be received from the same candidate.

No candidate shall receive more than one premium or bounty in the same year.

All performances to which premiums or bounties are adjudged, shall remain with the Society until after the second Wednesday in June 1827, when they will be redelivered, unless mentioned in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

All performances must have been executed within the year previous to their being sent in to the Society, except the finished engravings on steel and copper, which must have been excuted within two years.

No performance can be received which does not come into one of the foregoing classes, and which does not agree with the conditions of the class in which it is introduced, except by a particular recommendation from the committee, and confirmed by the Society, that it is deserving of being made an exception to the general rule, and in such case a bounty may be given.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the candidates affix on the front of their performances whatever mark they please, each performance having a different mark; and that the same mark be inscribed on the outside of a paper sealed up, containing within, the name and residence of the candidate, and *on the outside*, the sex, and age, and the number of the premium in claim of which the performance is offered, and whether the candidate has previously received from the Society any and what reward; the name not to be disclosed unless the candidate be successful, or in consequence of a special vote of the Society, or Committee.

If a person is a candidate in more than one class a separate letter must be sent in with each performance.

To prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the candidate, the Society require a specimen of the abilities of each successful candidate to be made under the inspection of the committee of polite arts.

All copies are to be on a different scale from the original; and, if possible, the original is to be sent with the copy.

The Society reserve to themselves the power of giving medals of less value than those proposed; or of withholding them altogether in cases where the performance shall be deemed undeserving of reward. But if there should be, in the same class, more than two works of merit, deserving encouragement, the committee is allowed to recommend, at the same time, to the Society that a bounty be given; and in case of the second premium offered being the lowest reward, which the Society gives, such lowest reward may be repeated as a bounty.

In consideration of the great number of premiums here offered, embracing so many departments of the fine arts, no bounty can be given, except by a special recommendation in cases of extraordinary merit; the reason of such recommendation to be particularly stated in the report of the committee.

PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

Claims for the following premiums are to be sent in on or before the second Tuesday in February, 1827.

Fine Wool.

229. To the person who shall have produced from his own flock, in the year 1826, the greatest quantity, not less than 5 cwt. of wool equal to the Spanish merino, and as fit for the purpose of being manufactured into superfine cloth; —*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it, to be produced to the society.

230. For the next greatest quantity, not less than two hundred and fifty pounds:—*the Silver Medal,* on similar conditions.

Transparent Paper for Tracing.

231. For a method of making transparent paper, better than any hitherto in use, and that shall take and bear common writing-ink with the same facility and correctness as writing-paper;—*the Silver Medal, or Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced to the Society.

Leather for Gloves.

232. For a process equal or superior to that of the French, for preparing, dyeing, and finishing skins, for fine gloves, verified by actual experiment, and the communication accompanied with, at least, a dozen pair of gloves made from skins so prepared;—*the Gold Medal, or Thirty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society.

Hose for Fire-Engines, Brew-houses, &c.

233. For a method of making hose for fire-engines, brew-houses, &c. similar to those used on the continent, made of flax or hemp,

or other flexible material cheaper than leather;—*the Gold Isis Medal, or Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of its efficacy in practice, to be produced to the Society.

Thread for Lace.

234. For a method of manufacturing thread from flax, of as fine quality as any used on the continent;—*the Gold Medal, or Thirty Guineas.*

Samples of the thread, not less than one pound in weight, and of the lace made therefrom, together with certificates that not less than ten pounds in weight have been manufactured, to be produced to the Society.

Thread for Lace or Cambric.

235. For a method of producing thread from flax grown in the United Kingdom, of as fine a quality as any made on the continent;—*the Gold Medal, or Thirty Guineas.*

Conditions the same as for the preceding.

Shawls of Cachemire Wool.

236. For a shawl made of Cachemire wool, and which shall be the best imitation of the real Indian shawls made from the same material;—*the Gold Medal, or Thirty Guineas.*

Certificates from competent persons, approving the articles manufactured, with a full account of the process employed therein, to be produced to the Society.

Shawls in imitation of Cachemire.

237. To the person who shall manufacture, of any material, except Cachemire wool, and produce to the Society a shawl equal in beauty, and in fineness of texture, to the best Indian shawls made of Cachemire wool;—*the Gold Medal, or Thirty Guineas.*

Conditions the same as for the preceding.

Winding Silk.

238. For a method, better than any hitherto known, of winding raw silk that is in any degree sticky in its gum, or brittle in its texture, without injuring its colour or texture, and at a cost not exceeding that of the ordinary methods;—*the Silver Medal, or Twenty Guineas.*

A full description of the process, and apparatus used, and samples of the silk, both in its wound and raw state, together with certificates of the process having answered the required conditions, to be produced to the Society.

Organzine Silk.

239. For a method by which to organzine silk equal in quality to the Italian throw, at an expense less than the current price of throwing;—*the Gold Medal, or Fifty Guineas.*

The communication, with a full description of the process, and models or drawings of the apparatus employed, and samples of the produce, with certificates of the invention answering the required conditions, to be produced to the Society.

Machine for Silk-weaving.

240. For a machine for weaving figured silks, superior in its mode of action, and in the nature and extent of the work it will produce, to the looms at present known;—*the Gold Medal, or Fifty Guineas.*

Certificates of the performance of the machine, and a model of the same, to be produced to the Society.

Machine for Weaving Ribbons.

241. For a machine for weaving figured ribbons, superior in the nature and extent of the work performed to the looms at present known;—*the Gold Vulcan Medal, or Thirty Guineas.*

The improved plan to be capable of producing ribbons equal in texture to those of French manufacture, and to perform well in every respect. The en-

tire height of the loom and its appendages not to exceed eight feet. Specimens of the ribbons made with the improved loom, to be produced to the Society.

Power Looms for Figured Silk or Ribbons.

242. For a machine for weaving figured silks or ribbons, by which the best sorts of works may be executed, and to which steam, or any similar power may be applied; —*the Gold Medal, or Fifty Guineas.*

Conditions the same as the last but one.

Hats or Bonnets from British Materials.

243. For the best hats or bonnets made from spring-wheat or other article of British growth, which shall approach the nearest to the texture and colour of Leghorn-plat;—*the Silver Medal, or Twenty Guineas.*

An account of the material and of the process employed in the manufacture, with certificates that not fewer than ten dozen of equal quality with the sample have been made, to be produced to the Society.

244. For the next greatest quantity not less than two dozen;—*the Silver Isis Medal, or Ten Guineas.*

Plat from British Material.

245. To the person who shall manufacture from spring-wheat or other material of British growth, and shall produce to the Society, the largest quantity (not less than one hundred score) of plat fit for manufacturing bonnets, equal in texture to that imported from Leghorn;—*the Silver Medal, or Ten Guineas.*

246. For the next in quantity (not less than fifty score);—*the Silver Ceres Medal, or Five Guineas.*

Samples of the plat, not less than five score, with certificates of the quantity manufactured, and its quality being equal to the samples, to be produced to the Society.

Pillow Lace.

247. To the person who shall manufacture the best specimen of lace made on the pillow, equal to the French;—*the Gold Vulcan Medal, or Twenty Guineas.*

Certificates that at least twenty yards of lace, two inches or upwards wide, have been so made, and a sample of one yard to be produced to the Society.

Matting.

248. For the best specimen of matting, resembling India matting used for covering rooms, made from materials grown in Great Britain;—*the Silver Medal, or Twenty Guineas.*

Certificates that not less than fifty yards of this matting have been manufactured, and that it will answer the purpose of India matting, and can be afforded at a less price, together with a sample of not less than six yards, and a complete account of the process of manufacture, to be produced to the Society.

British Cambric.

249. For having manufactured, or caused to be manufactured, the best specimen of British cambric, not fewer than ten pieces;—*the Gold Vulcan Medal.*

Certificates, and one piece as a specimen, to be sent to the Society.

PREMIUMS IN MECHANICS.

Claims for the following premiums to be sent in on or before the last Tuesday in February 1827.

Gunpowder Mills.

250. For the most effectual mode of preventing explosions in gunpowder mills;—*the Gold Medal, or One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more gunpowder-mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society.

N.B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of gunpowder-making, which fall short of the total prevention of explosion, such bounty or reward will be bestowed on them as they may appear to merit.

Machine for raising Water.

251. For a machine, on a better, cheaper, and more simple construction than any hitherto known for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal, or Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, to be produced to the Society.

Extinguishing Fires.

252. For a method for preventing or extinguishing fire in buildings, superior to any now in use;—*the Gold Medal, or Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society.

This premium is offered in compliance with a recommendation in the will of the late Dr. Anthony Fothergill.

Boring and Blasting Rocks.

253. For a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of boring and blasting rocks in mines, shafts, wells, &c.;—*the Gold Medal, or Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society.

Warming Buildings.

254. For a method of heating rooms, superior to and cheaper than any hitherto known or in use;—*the Gold Medal, or Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society.

Improved Ventilation.

255. For a mode of permanently ventilating hospitals, workhouses, stables, and other buildings, superior to any now known or used;—*the Gold Medal, or Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates, to be delivered to the Society.

Ventilating Coal Mines.

256. For a method of ventilating coal mines so as effectually to prevent the accidents liable to

arise from the accumulation of carburetted hydrogen and other gases;—*the Gold Medal, or Fifty Guineas.*

A full account of the process, with certificates of its efficacy, to be produced to the Society.

N.B. The Society will be very glad to attend to any communication, which, though not completely effecting the object, appears to offer an approximation to it. The Society wish particularly to refer candidates for this premium to the communication made by Mr. Ryan, and published in the 34th vol. of the "Transactions;" and will consider themselves obliged to any person who will furnish any information with respect to the attempts which have been made to introduce Mr. Ryan's mode of ventilating coal mines into actual use, and of the success with which this method has been attended.

Preventing Accidents from Stage Coaches.

257. For a method of preventing accidents arising from stage coaches;—*the Gold Medal, or Thirty Guineas.*

Ample certificates of its efficacy, with a description and model, to be produced to the Society.

N.B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not, in some degree, be prevented by an alteration in the manner of placing the luggage.

Improving Turnpike and other Roads.

258. For the most effectual and cheapest method, verified by actual experiment, of making an even, hard, and durable carriage-road;—*the Gold Medal, or Thirty Guineas.*

It is required, that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society.

Preventing Prejudicial Effects to the Persons employed in Dry-grinding.

259. For a mode, superior to any hitherto published, of obviating the prejudicial effects that attend the operation of pointing needles, and other branches of dry-grinding, during which the particles of grindstone-dust, steel, and iron, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal, or Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society.

Preventing Explosions in Steam-engine and other closed Boilers.

260. To the person who shall invent and discover to the Society a method of rendering closed boilers used for steam-engines and other purposes, safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal and Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society.

Machine for Sweeping Chimnies.

261. For an apparatus for sweeping chimnies, superior in facility of application and efficacy to any hitherto used;—*the Gold Medal, or Thirty Guineas.*

A complete model and description of the apparatus, with certificates of its successful and continued use, to be produced to the Society.

A superior Screw.

262. For a mode of producing a more accurate screw than any hitherto known;—*the Gold Medal, or Thirty Guineas.*

A model or complete drawing and description of the method, with a screw not less than twelve inches in length, to be produced to the Society.

Canal Locks.

263. For a plan of a lock for a canal, by which, on the passing of a boat, less water may be ex-

pended than has hitherto been the case, and through which a boat may pass in a time not materially longer than is required for passing locks of the usual construction;—*the Gold Medal, or Fifty Guineas.*

Certificates of the plan having been successfully carried into practice, together with a full description, and drawings or models in illustration of the same, to be sent to the Society.

The same premium is offered for the year 1828.

Passing Boats through Tunnels.

264. For a method, superior to any hitherto known, whereby a boat may be impelled or drawn through a tunnel not having a towing path;—*the Gold Medal, or Thirty Guineas.*

Conditions the same as the last.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE AND THE BRITISH COLONIES.

Claims for the following premiums are to be sent in on or before the second Tuesday in March, 1827,

Curing Mackarel.

265. For the greatest quantity of mackarel, not less in number than ten thousand, cured in the year 1826, in the best manner, and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal, or Twenty-five Guineas.*

266. For the next greatest quantity, not less than five thousand;—*the Silver Medal, or Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums are extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

Cachemire Wool.

267. To the person who shall import the greatest quantity of real Cachemire wool, not less than one cwt., freed from the hair, and in a state fit for spinning;—*the Gold Medal.*

Samples of the wool, not less than five pounds weight, with bills of lading and other necessary documents to be produced to the Society.

This premium is continued two years longer on similar conditions.

Importing the Cachemire-shawl Goat.

268. To the person who shall have imported into the United Kingdom, subsequent to the 1st of January, 1826, the greatest number, not fewer than three females and two males, of the real Cachemire-shawl goat;—*the Gold Medal.*

Certificates that the goats are of the real Cachemire breed, and that they are in health at the time of making the communication, to be produced to the Society.

This premium is offered also for the years 1827 and 1828.

Nutmegs and Mace.

269. To the person who shall grow the finest sample of nutmegs or mace, of good and merchant-

able quality, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, or in any British plantation on the coast of Africa, or of the several islands adjacent thereto, or in the island of Sincapore, and equal to those imported from the islands of the East Indies ;—*the Gold Medal.*

Satisfactory certificates from the governor, commander-in-chief, resident magistrate, or other competent local authorities, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced to the Society.

The same premium is offered for the years 1828, 9, 30.

Cinnamon.

270. A premium, similar to the preceding, and on the same conditions, is offered for the growth of cinnamon.

Cloves.

271. A premium, similar to the preceding, and on the same conditions, is offered for the growth of cloves.

For an account of cloves raised in the colony of Trinidad, see M. le Cadre's communication in vol. 43 of the Society's Transactions.

Pepper.

272. To the person who shall, previous to the year 1831, raise, in any of the British West Indian islands or colonies, and shall import the largest quantity, not less than 4 cwt., of good and marketable pepper ;—*the Gold Medal, or Fifty Guineas.*

273. For the next greatest quantity, not less than two cwt. ;—*the Gold Ceres Medal, or Thirty Guineas.*

Conditions the same as for No. 269.

Vanilla.

274. To the person who shall import from any of the British West Indian islands the greatest quantity of vanilla beans, the produce of such island or colony, equal in quality to those produced in Poyais and on the coast of Mexico ;—*the Gold Ceres Medal.*

Conditions the same as for No. 269.

Annatto.

275. To the person who shall import, from any part of the British settlements in the East Indies, the greatest quantity of annatto, equal to that imported from Spanish America, not less than one cwt. ;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the governor or secretary of the respective settlement, that the annatto is the produce of such settlement.

True Cochineal.

276. To the person who shall import, from any part of the British settlements in the East or West Indies, or any other British plantation, the greatest quantity of true cochineal, equal to that imported from Spanish America, not less than one hundred weight ;—*the Gold Medal.*

A quantity of cochineal, not less than three pounds weight, with proper certificates, signed by the governor or secretary of the respective settlement, or other competent local authority, that the cochineal is the produce of such settlement, to be produced to the Society.

West India Indigo.

277. To the person who, in the year 1826, shall raise the greatest quantity of indigo of good quality, not being less than one thousand pounds weight, in the island of Jamaica, or any other British plantation in the West Indies, and shall import the same ;—*the Gold Medal, or Fifty Guineas.*

Certificates from the governor or secretary of the colony, or from the justices of the peace or other competent local magistrates, that the indigo was raised in

the colony, together with samples, to be produced to the Society.

Extract of Mimosa Bark.

278. To the person who, in the year 1826, shall import into Great Britain the greatest quantity (not less than ten tons), of extract of mimosa bark, prepared in the colony of New South Wales, at a price not greater than that of the extract of foreign oak-bark, and equally applicable as that to the purpose of tanning;—*the Gold Isis Medal.*

Satisfactory certificates from the governor or secretary of the colony, or any competent local magistrate, that the extract was prepared from the bark of trees growing in the colony, together with a full account of the process of preparing it, and samples of the extract, to be produced to the Society.

Caoutchouc.

279. To the person who shall import from any British colony or settlement in the West Indies or on the coast of Africa, the greatest quantity, not less than one cwt. of good and marketable caoutchouc; —*the Gold Medal.*

Certificates from the governor or secretary of the colony, or any competent local magistrate, with samples, and an account of the mode of preparing the article, to be produced to the Society.

Silk.

280. To the person who, in the years 1826, or 7, shall raise in any British colony, and shall import, the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, from silk worms bred there;—*the Gold Medal, or Fifty Guineas.*

Specimens of the silk, not less than one pound, with an account of the method in which the silk-worms were managed, the kind of mulberry-trees from whence they were furnished with food, and particulars respecting the culture of the mulberry-trees for that purpose, to be produced to the Society.

281. For the next greatest quantity, not less than fifty pounds, on similar conditions;—*the Silver Medal, or Twenty Guineas.*

Satisfactory certificates from the governor, commander-in-chief, secretary of the colony, resident magistrates, or other competent local authority where the said silk was produced, and of the several particulars above-mentioned, to be delivered to the Society along with the samples required.

The same premiums are specially offered for the colonies of

282—283. The Cape of Good Hope;

284—285. The Mauritius;

286—287. New South Wales.

Short-reeled Brutia Silk.

288. To the person who shall have imported into Great Britain the greatest quantity of Brutia or Levant silk, not less than five bales (heretofore long-reeled), of a reel not more than 75 inches in circumference, so as to be wound by the engines in ordinary use;—*the Gold Isis Medal.*

Proper certificates, with bills of lading, and samples of the silk, to be produced to the Society.

Olive Oil.

289. To the person who shall, in the years 1827, 1828, or 1829, manufacture and import the finest specimen of oil, not less than ten gallons, the produce of olives grown in any British colony in Africa or New South Wales;—*the Gold Medal.*

290. For the next greatest quantity, not less than six gallons;—*the Silver Medal.*

Specimens of the oil, not less than two quarts, together with satisfactory certificates, to be produced to the Society.

Wine from the Cape of Good Hope.

291. To the person who shall import, in the years 1826 or 1827, the finest wine, not less than one pipe, of good marketable quality, made from the produce of vineyards at the Cape of Good Hope,

or the parts adjacent ;—*the Gold Medal.*

The above premium is not offered for the sweet or Constantia wine, the quality and value of which are sufficiently known, but to encourage the improvement of the vineyards more recently established.

Samples of the wine, in bottles, bills of lading, and certificates of the governor, secretary of the colony, or other local authorities, that the wine was made in the colony, to be produced to the Society.

Wine from New South Wales.

292. To the person who shall import, in the years 1826 or 1827, the finest wine, not less than one pipe, of good marketable quality, made from the produce of vineyards in New South Wales ;—*the Gold Medal.*

Samples of the wine, in bottles, bills of lading, and certificates of the governor, secretary of the colony, or other local authorities, that the wine was made in the colony, to be produced to the Society.

Dried Fruits.

203. To the person who shall prepare and import into Great Britain the greatest quantity, not less than 100lbs. of dried fruits, similar to those now imported from the Mediterranean, of good quality, and the growth of the colony of New South Wales ;—*the Gold Ceres Medal.*

Satisfactory certificates from the governor or secretary of the colony, or any competent local magistrate, that the fruits were grown and prepared in the colony, with samples of the fruits, to be presented to the Society.

This premium is also extended to 1828 and 1829.

The same premium, on similar conditions, is offered for the colonies of—

294. The Cape of Good Hope.

295. The Mauritius.

Cultivation of Tea.

296. To the person who shall grow and prepare the greatest quantity of China tea, of good quality, not being less than 20 lbs. weight, in the island of Jamaica, or in any other British West India colony and shall import the same into Great Britain ;—*the Gold Medal, or Fifty Guineas.*

Satisfactory certificates from the governor or secretary of the colony, or from the justices of the peace, or other competent local magistrate, that such tea was grown and prepared in the colony; together with an account of the number of tea-trees, their age, mode of culture, of gathering, drying, and preparing the leaves, and samples of the tea, to be produced to the Society. This premium is also extended to 1828.

The same premium is offered for the colonies of

297. The Cape of Good Hope ;

298. The Mauritius ;

299. New South Wales ; and the British dominions in the East Indies.

China Tea.

300. To the person who shall communicate to the Society, from information obtained in China, the best and most authentic account of the culture of the plant or plants, the leaves of which furnish the different kinds of tea ; together with the method of gathering, drying, and otherwise preparing the leaves ;—*the Gold Medal.*

This premium is extended to the years 1827 and 1828.

Cinchona.

301. To the person who shall communicate to the Society the best account of one or more of the species of cinchona, the bark of which is used in medicine, accompanied by specimens of the tree in leaf, flower, and seed ; and not less than 10 lbs. of the bark ;—*the Gold Medal.*

It would be desirable to have some of the seeds sent over in a state fit for vegetation, for which purpose it is recommended that they should be packed in fresh burnt charcoal powder, and wrapped up in coarse brown paper.

Kali for Barilla.

302. To the person who shall have cultivated, in the Bahama Islands, or any other part of his majesty's dominions in the West Indies, or in any other British plantation, in the years 1825 or 1826, the greatest quantity of land, not less than two acres, with a kali, equal to the Spanish kali, for the purpose of making barilla; —*the Gold Medal, or Thirty Guineas.*

303. For the next greatest quantity, not less than one acre; —*the Silver Medal, or Fifteen Guineas.*

Certificates, signed by the governor or commander-in-chief for the time being, the resident magistrates, or other competent local authorities, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali.

The same premiums, on similar conditions, will be given for kali grown in 1827.

Cultivation of Hemp in Upper and Lower Canada, Nova Scotia, and New Brunswick.

304. To the person who shall sow with hemp the greatest quantity of land in the above-mentioned provinces, not less than six arpents, (each four-fifths of a statute acre) in the year 1826, and shall at the proper season cause to be plucked the summer hemp, (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal, or Two Hundred Dollars.*

305. To the person who shall sow with hemp the next greatest quantity of land in the same provinces, not less than five arpents, in the year 1826, in the manner above-mentioned;—*the Silver Medal, or One Hundred Dollars.*

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad-cast or in drills, and of the expense, soil, cultivation, and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, of the resident magistrates or other competent local authorities, together with 28lbs of the hemp, and two quarts of the seed.

The same premiums are offered for the year 1827.

Importation of Hemp from Canada, Nova Scotia, and New Brunswick.

306. To the person who shall import to this country the greatest quantity of marketable hemp, not less than one hundred tons, in the year 1826, the produce of Canada, or of one of the above-mentioned provinces;—*the Gold Medal.*

307. To the person who shall import the next greatest quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

The same premiums are offered for the year 1827.

Substitute for Hemp.

308. To the person who, in the years 1826, or 1827, shall raise at the Cape of Good Hope, in New South Wales, or in any of the British colonies, and import, a substitute for hemp, not less than two tons, equally cheap, strong, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal, or Fifty Guineas.*

A quantity of the substitute, not less than 20lbs., together with the proper certificates from the governor, commander-in-chief, secretary of the colony, resident magistrates, or other competent local authority, in which the same has been raised, to be produced to the Society.

The Society particularly direct the attention of the public to the phormium tenax or New Zealand flax.

The same premiums are offered for the year 1827.

China Paper for Copper-plate Printing.

309. To the person who shall communicate to the Society the best account of the process employed in China for the manufacture of paper used in England for copper-plate printing, and known by the name of India paper, together with an account of the materials from which such paper is made;—*the Gold Medal, or Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates, to be produced to the Society.

Diminution of Human Labour in the Cultivation of Sugar, &c.

310. To the person who shall present to the Society a satisfactory account, founded on experience, of the most advantageous mode of diminishing the labour of persons employed in the cultivation of sugar, cotton, and coffee in the West Indian colonies, by the substitution of agricultural machinery, or by the use of cattle;—*the Gold Medal, or Fifty Guineas.*

Extirpating the Stumps and Roots of Trees.

311. To the person who shall invent and discover to the Society the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees which have been left after felling the timber, so as to clear the land for the purposes of cultivation.—*the Gold Medal, or Fifty Guineas.*

Certificates that the method has succeeded with at least fifty trees of large girth, and a full description of the means employed, to be delivered to the Society.

BRITISH MARBLES.

The Society, considering that it would be beneficial to the commerce of the United Kingdom to bring the British marbles into general use, and that the most effectual method of accomplishing their object would be, *for the present*, to make them more generally known in the capital, have come to the following resolution:—

That specimens of British marbles be exposed in the Society's rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name and situation of the parish, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of marble quarries will favour them with a specimen of the marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected, that the interest of the proprietors of the quarries will be promoted, and the use of British marble much extended. A variety are already exhibited in the Society's rooms.

REWARDS

BESTOWED BY THE SOCIETY DURING THE SESSION 1825-6.

IN MECHANICS.

1. To Mr. T. Collett, Upper Greystoke-place, Fetter-lane, for a pair of shears for making tags for laces, the *Silver Vulcan Medal.*
2. To Mr. George Hooper, 1, Bury-street, Chelsea, for a builder's level, *Five Guineas.*
3. To Mr. C. Hartley, 4, Essex-street, Battle-bridge, for a hand-rail sector, the *large Silver Medal.*
4. To Mr. W. Spencer, Ordnance-place, Chatham, for his improved method of letting go an anchor, the *Gold Vulcan Medal.*
5. To Mr. E. Carey, Bristol, for his improved dead eyes for shipping, the *Silver Vulcan Medal.*
6. To Mrs. Hen. Goode, Ryde, Isle of Wight, for a blind for circular-headed windows, the *Silver Valcan Medal.*
7. To Mr. James Skinner, 81, New Park-street, Southwark-bridge, for an improved stage coach, *Thirty Guineas.*
8. To the same, for a trap for vermin, *Five Guineas.*
9. To Mr. Joshua Jenour, jun. 31, William-street, Hampstead-road, for a shot cartridge, *Fifteen Guineas.*
10. To Mr. J. Adcock, 24, Leman-street, Goodman's-fields, for an adjustable door lever, the *Silver Vulcan Medal.*
11. To Mr. J. T. Towson, Devonport, for a banking for a chronometer, the *Silver Vulcan Medal, and Ten Guineas.*
12. To Mr. W. Palmer, Clifton-street, Finsbury, for an improved ruling machine for engravers, the *large Silver Medal.*
13. To Mr. D. Magson, 26, Harp-alley, Fleet-street, for a valve and stand-pipe for water mains, *Five Guineas.*
14. To Mr. G. Edwards, Lynn, Norfolk, for a levelling and surveying instrument, the *Gold Vulcan Medal.*
15. To Mr. C. Fay, 35, Piccadilly, for his forceps for dentists, the *large Silver Medal.*
16. To Mr. J. P. Holmes, 21, Old Fish-street, for his craniotomy forceps, the *Gold Vulcan Medal.*
17. To Mr. J. P. Clark, 5, King-street, Holborn, for his improved cupping apparatus, the *Silver Vulcan Medal.*
18. To Joseph Goodwin, Esq. Clerk of the Stables, Carlton Palace, for his table for veterinary operations, the *Gold Vulcan Medal.*
19. To Mr. S. Williams, 2, Stone-stairs, Ratcliff, for his drag for drowned bodies, the *Silver Vulcan Medal, and Five Guineas.*
20. To R. Cowen, Esq. Carlisle, for his apparatus to carry off the dust produced in dry grinding, the *large Gold Medal.*
21. To Mr. J. Alderson, 4, Bridge-row, Pimlico, for an instrument for describing arcs of circles the centers of which are not given, *Ten Guineas.*
22. To Mr. M. A. Alderson, Manchester, for a set of working drawings of a steam engine, *Thirty Guineas.*
23. To Mr. P. Henry, Limehouse, for a set of working drawings of a boat steam engine, *Twenty Guineas.*

The Thanks of the Society have been presented to the following Gentlemen, and their respective Communications have been directed to be inserted in the next Volume of the Society's Transactions.

To Bryan Donkin, Esq. Chairman of the Committee of Mechanics, for a German boring bit, and a French drawing pen.

To G. Mainwaring, Esq. Marsh-place, Lambeth, for a working drawing of an hydraulic pressure engine erected by him at Whitby.

IN CHEMISTRY.

24. To Mr. J. H. Abraham, Sheffield, for his mode of neutralizing magnetism in the balances of watches, the *large Silver Medal.*
25. To Mr. J. Roberts, St. Helen's, Lancashire, for his improved safe lamp for miners, the *Silver Vulcan Medal and Ten Guineas.*
26. To Mr. J. Cathery, 6, Hyde-street, Bloomsbury, for a mode of coloured etching on ivory, *Five Guineas.*
27. To Mr. W. Cooke, jun. 5, Seymour-street North, Clarendon-square, for improvements in etching on steel, the *Gold Isis Medal.*
28. To Mr. W. Humphrys, 65, Charlotte-street, Rathbone-place, for his menstruum for etching on steel plate, the *Gold Isis Medal.*

IN COLONIES AND TRADE.

29. To M. Barbé, the Mauritius, for importing 76 tons of cocoa-nut oil, the *Gold Ceres Medal.*

The Thanks of the Society were voted

30. To Mr. Huxham, of Travancore, for his method of preventing leakage in casks of cocoa-nut oil, and the same was ordered for publication.

IN POLITE ARTS.

31. To Mr. C. Galpin, of Charmouth, Dorset, for his mode of applying black-lead in drawings, the *Silver Isis Medal.*
32. To Mr. W. Tuson, 9, Queen-street, May-fair, for models in wax of fruit, the *Silver Isis Medal.*
33. To Mr. D. Fox, Derby, for an improved mode of casting in plaster of Paris, the *large Silver Medal.*

COPIES IN CHALK, PENCIL, OR INDIAN INK.

34. To Mr. J. Bizo, 6, White-rose-court, Coleman-street, for a drawing in Indian ink of a head, the *Silver Palette.*
35. To Mr. W. J. Chambers, 73, Long Acre, for a copy in pen and ink of an historical subject, the *Silver Isis Medal.*

35.* To Mr. F. H. Crace, Notting-hill, Kensington, for a copy in pencil of an historical subject, the *large Silver Medal.*

36. To Miss Eliza Stephens, West Brixton, Surrey, for a copy in chalk of figures, the *Silver Isis Medal.*
37. To Miss Mannoir, Grove End-place, Regent's-park, for a copy in chalk of figures, the *Silver Palette.*
38. To Miss B. S. Wiggins, 130, Piccadilly, for a copy in pencil of a landscape, the *Silver Isis Medal.*
39. To Miss Arabella Thynne, Poet's-corner, Old Palace-yard, for a copy in pen and ink of a landscape, the *Silver Palette.*
40. To Miss F. H. Henslow, Cambridge, for a copy in chalk, of an historical subject, the *Silver Isis Medal.*

COPIES IN WATER COLOURS.

41. To Miss M. A. Cockburn, St. John's-grove, Regent's-park, for a group of portraits, the *large Silver Medal.*
42. To Miss M. E. Friend, 175, High-street, Shoreditch, for a copy in water colours of a landscape, the *large Silver Medal.*
43. To Miss Clark, 1, Bedford-place, Kensington, for a copy in water colours of flowers, the *large Silver Medal.*
44. To Miss Birtha Thatcher, Mrs. Yeates's, York-house, Walham-green, for a copy in water colours of fruit, the *Silver Palette.*

ORIGINAL IN WATER COLOURS.

45. To Miss Charlotte Chapman, 37, Great Russell-street, for a composition of flowers, the *large Silver Medal.*
46. To Mr. W. Downor, 8, Brewer's-street, Woolwich, for a composition of flowers, the *large Silver Medal.*
47. To Miss Matilda Jones, 8, Coleman-street, for a portrait, a miniature, the *Silver Palette.*
48. To Miss Twining, 34, Norfolk-street, Strand, for a portrait, a miniature, the *large Silver Medal.*
49. To Miss Buckton, Edgebaston, Birmingham, for a landscape, the *large Silver Medal.*

ORIGINAL IN OIL.

50. To Mr. J. P. Andre, jun. 5, York-place, City-road, for a landscape composition, the *large Silver Medal.*
51. To Miss Manning, Norbury Priory, Leatherhead, for a group of portraits, the *large Silver Medal.*

ARTISTS.

COPIES IN CHALK, PENCIL, OR INDIAN INK.

52. To Mr. C. Bradbury, 39, Strand, for a drawing in pencil of a figure, the *Silver Palette.*
53. To Miss Caroline Derby, 9, Mornington-place, Hampstead-road, for a drawing in chalk of a head, the *Silver Palette.*
54. To Mr. W. Chevalier, 13, Clarendon-square, for a portrait in pen and ink, the *Silver Isis Medal.*
55. To Mr. James Eke, 46, Clarendon-street, Somers' Town, for a drawing in Indian ink of Ionic capitals, the *Silver Isis Medal.*
56. To Mr. J. Slade, 57, Hatton-garden, for a drawing in pencil of a landscape, the *Silver Palette.*
57. To Mr. Henry Guest, 13, Bear-street, Leicester-square, for a drawing in pencil of a landscape, the *Silver Palette.*
58. To Miss Raimbach, 10, Warren-street, Fitzroy-square, for a drawing in pencil of a landscape, the *Silver Isis Medal.*
59. To Mr. Cornelius Durham, 17, Arundel-street, Strand, for a drawing in chalk of animals, the *Silver Isis Medal.*

DRAWINGS AND PAINTINGS FROM STATUES AND BUSTS.

60. To Mr. W. Smith, 21, John-street, Crutched-friars, for an outline of the dancing faun, the *large Silver Medal.*
61. To Mr. G. F. Ball, 66, John-street, Fitzroy-square, for a finished drawing from a statue, *the large Silver Medal.*
62. To Mr. S. A. Hart, 5, Newcastle-street, Strand, for a finished drawing from a statue, *the Silver Isis Medal.*
63. To Mr. S. T. Jarrett, Jarrett's-place, Hackney-road, for a finished drawing from the life, *the Silver Isis Medal.*
64. To Mr. T. Brigstocke, 6, Charlotte-street, Bloomsbury, for a drawing in chalk from a bust, *the large Silver Medal.*
65. To Miss Alabaster, 38, Piccadilly, for a drawing in chalk from a bust, *the Silver Palette.*
66. To Mr. J. Reeve, 2, Brunswick-street, Stamford-street, Blackfriars, for a drawing in chalk of a horse's head, *the Silver Isis Medal.*

COPIES IN WATER COLOURS.

67. To Mr. James Walsh, C. J. Robertson's, Esq., Chiswick, for a composition of fruit, *the Silver Isis Medal.*
68. To Miss L. J. Green, 27½, Argyll-street, for a portrait, a miniature, *the large Silver Medal.*

ORIGINAL IN WATER COLOURS.

69. To Miss M. Ross, 52, Upper Charlotte-street, Fitzroy-square, for a group of portraits, a miniature, *the Gold Isis Medal.*
70. To Miss Jane Drummond, 5, Rathbone-place, for a portrait, a miniature, *the Silver Isis Medal.*
71. To Mr. Edward Stow, 14, King-street, Portman-square, for a landscape from nature, *the large Silver Medal.*

72. To Miss Eliza West, 2, North Parade, Bath, for a landscape from nature, *the Silver Isis Medal.*
73. To Mr. W. Hayley, 19, Southampton-street, Bloomsbury, for a composition of fruit, *the large Silver Medal.*
74. To Miss A. Gwennap, 20, Suffolk-street, Pall Mall East, for a composition of shells, *the Silver Isis Medal.*
75. To Mr. C. Bentley, 15, Mile End-road, for a landscape from nature, *the large Silver Medal.*

COPY IN OIL.

76. To Mr. D. Pasmore, 6, Salisbury-court, Fleet-street, for a composition of figures, *the large Silver Medal.*

ORIGINAL IN OIL.

77. To Mr. H. T. Bone, 47, Charlotte-street, Portland-place, for a portrait, *the large Silver Medal.*
78. To Mr. J. P. Downes, 1, Doughty-street, for a portrait, *the Gold Isis Medal.*
79. To Mr. R. W. Buss, 60, Jewin-street, Aldersgate-street, for a portrait, *the Silver Isis Medal.*
80. To Mr. J. W. Solomon, 8, King-street, Covent-garden, for a portrait, *the Silver Palette.*
81. To Mr. R. A. Clack, 3, Clarendon-street, Somer's Town, for a portrait, *the Silver Isis Medal.*
82. To Mr. W. R. Patterson, 2, Broadway, Westminster, for a landscape from nature, *the large Silver Medal.*
83. To Miss A. M. Arnald, 2, Weston-street, Pentonville, for a landscape from nature, *the Silver Isis Medal.*
84. To Mr. T. Clarke, 12, Guildford-street East, Spa Fields, for a composition of flowers, *the large Silver Medal.*
85. To Mr. W. R. Earl, 41, Chester-street, Kennington, for a group of animals, *the large Silver Medal.*

MODELS.

86. To Mr. R. D. Webb, 12, Charles-street, Middlesex Hospital, for a figure in the round, a copy, *the Silver Palette.*
87. To Mr. James Hacker, 42, Park-street, Camden Town, for a bust from the antique, *the Silver Palette.*
88. To Mr. M. J. Crake, 64, Norton-street, Fitzroy-square, for a figure in the round, a copy, *the Silver Isis Medal.*
89. To Mr. George Legé, 41, Foley-street, Portland-place, for a figure in the round, a copy, *the large Silver Medal.*
90. To Mr. E. G. Physick, 16, Park-terrace, Regent's Park, for an original group of figures, *the large Gold Medal.*

MODEL IN WAX.

91. To Mr. T. Taylor, Soho, Birmingham, for a miniature whole length portrait, *the Gold Isis Medal.*

CARVING IN WOOD.

92. To Mr. H. Bailes, 434, Oxford-street, for a carving of a bird, *the Silver Palette.*

ARCHITECTURE.

93. To Mr. Richard Richley, 5, King-street, Holborn, for an original design for a national gallery, *the Gold Medallion.*
94. To Mr. Benjamin Baud, 16, Upper Montague-street, Montague-square, for an original design for a national gallery, *the large Silver Medal.*
95. To Mr. J. H. West, 10, Villiers-street, Strand, for models of the arch of Constantine at Rome, and the west front of Peterborough Cathedral, *the large Silver Medal.*

ENGRAVING AND ETCHING.

96. To. Mr. W. Hill, 3, Colemore-row, Birmingham, for an engraving of a landscape, *the Silver Isis Medal.*
97. To Mr. George Edward Radclyffe, George-street, Edgbaston, Birmingham, for an engraving of cattle, *the Silver Palette.*

98. To Mr. J. H. P. Stubbs, 28, Alsopp's Buildings, New Road, for an etching of cattle, *the Silver Isis Medal.*
99. To Miss Eliza Lee, 14, Kensington-square, for an etching of a landscape, *the Silver Palette.*

SURGICAL STUDENTS.

100. To Mr. J. R. Alcock, 11, New Burlington-street, for a coloured model in wax of a dissected arm, *the large Gold Medal.*
101. To Mr. H. Attenburrow, 11, New Burlington-street, for an original coloured drawing of a dissected arm, *the large Silver Medal.*
102. To Mr. Joseph Towne, Royston, Cambridgeshire, for a model of a skeleton, *the large Silver Medal.*

IN AGRICULTURE.

103. To Mr. W. Stickney, Ridgemont, near Hull, for his improved variety of ray-grass, *the large Silver Medal.*
104. To Mr. J. Milton, 10, Great Marybone-street, for an improved bee-hive, *the Silver Ceres Medal.*

IN MANUFACTURES.

105. To Miss Pether, for silk raised in England, *the large Silver Medal.*
106. To Mr. Joseph Long, House of Industry, Barham, near Ipswich, for a hat of British Leghorn, *Ten Guineas.*
107. To Messrs. J. & A. Muir, Greenock, for a hat of British Leghorn, *the large Silver Medal.*
108. To G. Mainwaring, Bennenden, near Cranbrook, for a hat of British Leghorn, *Ten Pounds.*
109. To Frances Cobbin, Bury St. Edmunds, for a hat of British Leghorn, *Eight Guineas.*
110. To Mrs. Ingledon, Aldborough, Yorkshire, for a hat of British Leghorn, *Five Guineas.*
111. To Mrs. Lowrey, Exeter, for a hat of double split wheat straw, *Five Guineas.*
112. To Mr. J. Horne, jun. Kenninghall, near Bury St. Edmunds, for Leghorn plat made of English spring wheat, *Ten Guineas.*

The following Candidates in Polite Arts have each had a Medal awarded to them; but by the Rules of the Society are precluded from receiving it, having had on former occasions an equal one in the same Class of Art.

Miss S. Field, Grove Lodge, Lower Tooting.
Miss H. Salmon, 86, Piccadilly.
Miss Is. Waters, Clapton-square, Hackney.
Mr. E. W. Webb, Tamworth, Staffordshire.
Mr. H. Pearsall, Bath.
Mr. S. Clint, Rolls-buildings, Fetter-lane.

Since the last DISTRIBUTION, Seventy-Six Members have been elected.

By Order,

ARTHUR AIKIN, *Secretary.*

TRANSACTIONS

OF

THE SOCIETY

DURING THE SESSION 1825-26.

PAPERS

IN

AGRICULTURE.

No. I.

IMPROVED RAY-GRASS.

The LARGE SILVER MEDAL *was this session voted to Mr. W.* STICKNEY, *of Ridgmont, near Hull, for a variety of Ray-grass superior to those commonly in cultivation. The following communication has been received from Mr. Stickney on the subject.*

Ridgmont, near Hull,
1 Mo. 16, 1826.

RESPECTED FRIEND,

A FRIEND of mine having handed me a list of premiums, offered by the Society of Arts, &c. amongst which is the Silver Medal for a specimen of ray grass, and described in No. 23 of that list; and flattering myself that I have for several years been cultivating a sort which fully answers every description there given, I hereby offer myself as a candidate for No. 23 in your list, hoping that the printed de-

scription of the grass, with the annexed certificate of its merits, signed by several of my neighbours well acquainted with it; together with a few pounds of the seed, which I will take care to send, will be as much as will be required: but if a specimen of an entire plant is expected, I will take care to send as complete a one as the season of the year will afford. I am afraid no seed stems can at present be procured; but if as much of a plant as the season will afford is expected, I will thank thee to inform my friend, Wm. Iveson, who, I expect, will be the bearer of this, and he will communicate the same to me.

I am, very respectfully, thy friend,

WM. STICKNEY.

A. Aikin, Esq.
Secretary, &c. &c.

Ridgmont, near Hull,
1 Mo. 25, 1826.

RESPECTED FRIEND,

I sent by the post, on the same day on which I sent the grass-seed, a written communication, addressed to thee, offering myself a candidate for the medal; and also a written certificate, signed by the persons whose names are attached to the printed one, except one, viz. Richard Brigham, who is since deceased, which certificate I apprehend will comprise all that is required by the conditions. I am aware that the printed paper is more than you require; but as I wish nothing to be kept secret as to the manner of my obtaining the grass, I thought, as the printed paper gave a full description of that, it possibly might be a hint to others, by which they might probably obtain a variety even superior to mine. I have now six

or seven other sorts coming forward, some of which promise to have qualities superior to this now offered to your notice, but I have not yet had sufficient time fully to ascertain their merits.

As a complete plant, furnished with a seed stem, cannot at this season of the year be procured, I had requested my friend to inquire whether that part of the requisition was expected; if it is I wish thee to inform me immediately, and such as the season will afford I will send. Perhaps a small sod, of a few inches diameter, fixed in a flower-pot, will be the best.

I am, very respectfully, thy assured friend,

A. Aikin, Esq. WM. STICKNEY.
Secretary, &c. &c.

Ridgmont, near Hull,
2 Mo. 20, 1826.

RESPECTED FRIEND,

I have herewith sent thee some specimens of my grass. Nos. 1, 2, 3, and 4, were gathered the second of this month: the seed of this was sown without a crop of corn, and without any manure on the land, the 18th of September, 1824. In the summer of 1825 it was seeded; the plants still have some of the old leaf and the stubble of the seed-stems attached to them. No. 1 was a plant rather detached from the general sward; the others were taken from where it was more thickly matted. Nos. 5, 6, 7, and 8, gathered at the same time, are plants from seed sown on the 23d of September, 1825, but on account of the dryness of the soil did not vegetate, so as to be perceptible, until November. The land was fallowed, being well cleaned, and no manure

applied except lime; manure is not applied, lest it should bring the seeds of other plants. Nos. 9 and 10 gathered the 3d of February; sown with clover on wheat the 22d of April, 1825. From this field was reaped a heavy crop of wheat, and is now intended for grazing the next summer. Nos. 11, 12, and 13, gathered the 16th of February, and from the same as 5, 6, 7, and 8, as described above. Nos. 14, 15, and 16, gathered the 16th, from the same as 9 and 10, described above. Nos. 17 and 18 gathered the 16th, from the same as 1, 2, 3, and 4, as described before. Notwithstanding all these are plants of the same grass, yet they vary very much, according to soil, situation, and other local circumstances.

In thy last letter thou asks me if I know any thing of the comparative merits between Mr. Whitworth's grass and mine. With Mr. Whitworth I have been acquainted for some years: his grass I have never seen. I have requested at different times (for some years past), that he would furnish me with some of his seed, in order that I might contrast it with mine; he has promised to do so, but has hitherto failed. The greatest proportionate demand for my grass (except in my own immediate neighbourhood) is in the north of Lincolnshire, where I suppose Mr. Whitworth's will be most known.

Had I not received thy last letter, describing the manner of drying and preparing the plants you requested to have, it was my intention to have sent you some specimens of the sward of my grass, from eight to ten or twelve years standing. Its most peculiar merit consists in forming a thick, luxuriant, and durable sward, and growing at all seasons of the year when the weather is mild. It is the least affected by drought of any grass in my knowledge:

when other pastures are burnt up, in dry weather, it will exhibit a fine luxuriant verdure.

I am, very respectfully, thy assured friend,

A. Aikin, Esq. WM. STICKNEY.
Secretary, &c. &c.

CERTIFICATES.

Ridgmont, October 2, 1817.

We, the undersigned, occupiers and cultivators of land in Holderness, have this day viewed several plots of land, sowed at different periods of time by Mr. William Stickney, in his farm at Ridgmont, with the particular grass-seed cultivated by him. All the specimens show, that the sward of this grass is more readily formed and of much better quality than that of any other grass with which we are acquainted; and whether in permament pasture or in seeding land, its superiority is sufficiently apparent.

JOSEPH STORR,
ROBERT BELL,
ROBERT STUBBING,
THOMAS DODDS,
JOHN COLLINS,
WILLIAM IVESON,
JOHN TAYLOR,
RICHARD BRIGHAM*.

About the year 1802 I commenced cultivating several sorts of grasses. I soon discovered that those worthy of cultivation were but few in number. Amongst several sorts I was then in possession of I found a variety of the

* Mr. Brigham is since dead.

ray-grass to have merit beyond any other: this variety I had selected from some particular rich looking plants. I continued to extend the cultivation of it for several years. About the year 1806, I formed an opinion, from observation, that some of our richest pastures continue their richness and verdure without the grasses ever being reproduced from seed. The appearance of the little field, in the front of the house of my friend Richard Brigham, led me to this conclusion: I had observed it to be always eaten very bare and never knew any of it produce seed; I therefore concluded it must be stocked with grasses of a permament kind, and had a good deal of curiosity to ascertain what they were. I obtained of my friend, R. Brigham, a small sod considerably less than a square yard. I placed it in a situation where it had an opportunity of showing its seed, and to my great surprise it proved to be, nearly without exception, the variety of ray-grass now before the Society.

I continued to extend its cultivation every year, continuing also to contrast it with the best purchased ray-grasses and other grasses I could procure, and it has always maintained a very great and decided superiority. I was rather apprehensive for some time that its merit might have consisted in habit which it had acquired by soil or situation, or rather by the particular manner in which it had been treated (being always grazed), and that when it came to be cultivated like other ray-grass it might degenerate; but after more than ten years cultivation I did not find that that was perceptibly the case.

It has the property of forming a thick matted sward from the abundance of bottom grass which it continually puts out, and it continues to grow at all seasons of the year when the weather is mild. From this variety having esta-

blished itself in most of the richest and best pastures in Holderness, to the almost total exclusion of the other grasses, it has obtained the name of Old Holderness.

W. S.

We certify that the variety of perennial ray-grass, *lolium perenne*, of which a specimen is produced by Mr. William Stickney, of Ridgmont, in Holderness, has been cultivated by him, on his farm at Ridgmont, more than eight years; that he now has more than ten acres sown with it, for the produce of seed; more than forty acres sown entirely with it, and laid for swarth, of several years growth; and more than eighty acres sown along with red or white clover, and intended for hay or grazing for two or three years. We also certify that in our opinion it is superior to any other variety of the same species of grass; and referring to the annexed certificate, which we gave in the year 1817, we have no hesitation to add, that our subsequent observations and experience have enabled us to confirm the opinions then given by us.

Given under our hands this 16th of January, 1826.

ROBERT BELL.
JOHN COLLINS.
JOHN TAYLOR.
THOMAS DODDS.
ROBERT STUBBING.
JOSEPH STORR.
WILLIAM IVESON.

Specimens of the grass, as described in Mr. Stickney's second letter, are in the Society's collection.

No. II.

IMPROVED DOUBLE BEE-HIVE.

The SILVER CERES MEDAL *was this session presented to Mr.* J. MILTON, 10, *Great Marylebone-street, for his Double Bee-hive. The following communication has been received on the subject, and a model of the Hive has been placed in the Society's Repository.*

London Apiarian Repository, 175, Strand,
March 29, 1823.

SIR,

BEING desirous to submit to the judgment and opinion of the Society of Arts, in the hope of their approbation, my improved hive for bees, I beg the favour of you to present the accompanying model for their inspection, to which I take the liberty to add the following remarks, from my own practical experience. I have read with much pleasure Mr. Espinasse's valuable and instructive Essay on the Management of Bees, and his objections to the possibility of taking the honey without destroying the bees; or, if it was practicable, of any general benefit to result from it: but I hope that in some respect I may be able to obviate that objection, and to promote the views of the Society, by my improvement in the construction of the double-topped hive. The hives in use at the present time are subject to the following objections:—the difficulty of hiving the bees; the admission of cold air in winter from the openings; the risk in remov-

ing the glasses and disturbing the bees; as well as the apparatus being too expensive to be purchased but by few. As the great object which the Society wish to attain is a method of procuring honey from the bees, without having recourse to the necessity of smothering them, I presume to hope, the hive now presented to the inspection of the Society is so constructed that the honey may be taken without destroying or even disturbing the bees. It is composed of the best unthrashed straw, the size of the hive is ten inches in height and thirteen inches in diameter in the clear: in the upper round, within, is attached a small straw band, supporting a circular board thirteen inches across, to which is affixed a fifteen inch circular board, both of which are prepared with openings suitable to the size of the glasses in which the bees are intended to work, when fixed for that purpose; or a small straw hive, to hold about ten pounds of honey, might be placed over the openings instead of the glasses; by this means the honey may be taken by degrees, without taking the lives of the insects who gather it. To hive a swarm in the double topped hive, the process is in the usual way, but taking care to secure the top board by adjusting the thumb screw, to prevent the bees from ascending when they are hiving. The hive should be brought into the apiary in the evening, the clear glass hives placed on the upper board, taking care to place each glass over its respective opening; let the glasses be stopped round with lime; adjust the thumb-screw, and turn the board, to enable the bees to ascend; cover these glasses with a straw hive, and leave them for a few days untouched; nothing will then be required but to take away the glass hives when they are filled (in doing which, it will be unnecessary to turn the board to exclude

the bees). Hives, in a favourable season, will be found full of combs and honey in twenty days. A hive can support four glasses, each holding two pounds; and twice filled in a good season would produce sixteen pound of honey and wax, leaving a sufficient supply in the straw hive for the support of the bees in the winter. The honey thus obtained would be of the very finest quality, and perfectly free from the young brood.

From the use of these hives the bees are under the immediate inspection of the owner, and may be managed with the least possible difficulty, as they require no particular attention more than the common ones: and, with the highest deference to the opinion of the Society, I am prepared to show, and I beg to assure them, that I have kept bees in all the various hives now in use, and that the swarms in the double-topped hives which I have deprived of honey, by means of glasses, twice last year, are as strong now, and healthy, and in every respect equal to any of my other stocks. I have also received the assurance of those bee masters whom I have supplied with these hives during the last three years, of the benefit to be derived from them, and the advantage they are calculated to produce.

With respect to the objection of the price of my hive being beyond the reach of the poorer classes, I beg to observe, that the price of my hives, as well as the simple method of management, will allow the cottager to avail himself of the use of them, and thereby enable him to bring to market honey and wax of a much finer quality, and earlier in the year, than from the hives hitherto used in the common form.

A. Aikin, Esq.
Secretary, &c. &c.

I am, Sir, &c. &c.
JOHN MILTON.

CERTIFICATE.

SIR, Cropney, February 20, 1824.

I think the double-topped hive fully answered. I took from it four glasses of honey containing about three pounds each; and in a favourable season, I have no doubt the bees would have sufficient left to support them. As it is, I am obliged to feed them, but I reckon that six pounds of honey will be sufficient for that purpose; and those stocks from which none has been taken, will not have more than enough to keep them, and will probably want a little feeding before they begin to work. So that in the most unfavourable season (which I suppose the last has been), six pounds of the best honey may be obtained, from each hive, by means of the glasses, and the bees be kept in as flourishing a state as if none had been taken.

I am, Sir,
&c. &c. &c.

Mr. J. Milton. J. BALLARD.

No. 10, Great Marylebone-street,
SIR, May 9, 1826.

In compliance with your letter, I respectfully forward to the Society the model of my invented *double* or revolving top bee-hive; and the under stated dimensions* are what

* Fourteen inches diameter in the clear, seven inches in height. It is essential that the straw should be thick in the coils.

I use, and find them most advantageous: you will see that by making *three holes, all* within the half of a circle, one glass may be taken off at a time. I do not consider this any advantage, but only in case one of the glasses is filled and the others not.

I am, Sir,
&c. &c. &c.
JOHN MILTON.

A. Aikin, Esq.
Secretary, &c. &c.

Fig. 1.

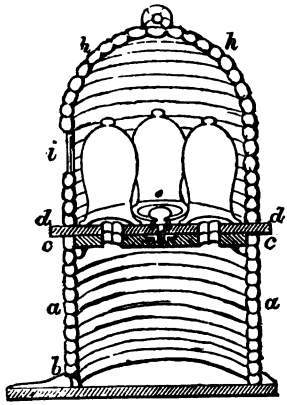
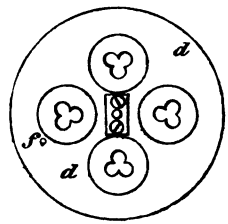


Fig. 3.



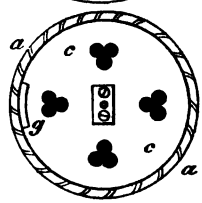


Fig. 2.

Fig. 1 shows the hive in section. *a a* the body of the hive, *b* the entrance, *c c* the top, which is a round board nailed in its place, shown also in fig. 2; *d d* another board, shown separate in fig. 3; it is held to the other by a central screw *e*, on which it turns, but its motion is limited by the check-pin *f*, fig. 3, which goes through the board and enters the channel *g*, fig. 2, so that when the pin is at one end, the holes through the two boards exactly coincide, and

when moved to the other end the communication is cut off. Over these holes are put four bell-glasses, three of which are shown in the section, and four circles mark their place in fig. 3, and over all there is put the cover *h h*; it has a small window at *i*. When the glasses are full the board may be turned, to shut the communication, and empty ones put in their place; also, if needful, food can be given them by means of these glasses, instead of their honey.

No. III.

Extract of a Letter from Dr. THACKERAY, of Chester, respecting his Plantations.

SIR, Chester, November 5, 1825.

I TAKE this opportunity of mentioning, that I have this week sent from Runcorn to Llanarmon, in Denbighshire, above one hundred bushels of acorns, having sowed and dibbled, many years ago, near one hundred and thirty bushels.

The plantations for which I obtained the three gold medals of your Society have been annually *pruned* and thinned; and some of the larch growing at Gelli Gynan have been sold for ten shillings a single tree, and one, which is particularly luxuriant, has been valued at fifteen shillings. Most people consider a tree, when once planted, as done with, though, as every experienced planter knows, the progress and products of trees, like those of other plants, may be greatly increased by pruning and thinning. The

most important part of tree culture is *pruning*, since, on it depends, where straight timber is the object, the ultimate value, and the actual bulk produced. Pardon this intrusion.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. M. THACKERAY.

A friend, who is settled in the Illinois, in North America, has promised to supply me with the seed of different forest-trees in the spring, which he is satisfied will thrive luxuriantly upon the mountains in North Wales: at all events I will make the experiment.

No. IV.

WINTER BEANS.

The THANKS of the Society were voted to JOHN SMITH, Esq. of Revel End, Herts, for the following communication respecting Winter-sown Beans, which was ordered to be printed.

24, Wellington-crescent, Ramsgate,

DEAR SIR, November 8, 1826.

I PROMISED, when the crop of winter beans should be gathered in, the produce of the small sample I had from the Society (for which Mr. Taunton, of Cheam, was rewarded in 1823), to report to you their condition and quantity.

I have the pleasure to say, that from so small a sample the quantity was three bushels of beans, as fine as any I have had the opportunity to inspect. They were sown under the ordinary Hertfordshire management, in October last year, and were quite in a fit state for in-gathering before I left Revel End for the continent, early in August last. I gave directions for reserving the three bushels for seed this year.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN SMITH.

DEAR SIR, Revel End, Aug. 31, 1825.

I have great pleasure in forwarding to you, for the information of the Society of Arts, a letter addressed to me by my tenant Mr. Lavender, of this place, detailing his successful progress in the cultivation of the winter bean, and upon which I promised a further report.

I am gratified to find that he is not only satisfied with, but that he greatly prefers them to the *late* bean in common cultivation here. I have no doubt of his being the means of introducing them into general cultivation in this part of the country.

I shall take care to communicate the result of next year's trial, and am pleased to add this to the many previous proofs of the usefulness of the Society's rewards.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN SMITH.

DEAR SIR, Revel End, Aug. 30, 1825.

Agreeably to your request, I now beg to communicate to you, for the information of the Society of Arts, the particulars of the small quantity of winter beans I took of you.

I ploughed one rood twenty-two poles of barley stubble, and planted the beans in October last. The crows unfortunately found out the seed upon eight poles of ground; yet, notwithstanding, the produce is fourteen bushels. They were ripe in July, and cut on the 23d of that month. The fourteen bushels I have I mean to drill on five acres of ground this season, and am fully convinced they are far superior to any that are sown in the spring.

I am, Sir,

&c. &c. &c.

John Smith, Esq. JOHN LAVENDER.

PAPERS

IN

CHEMISTRY.

No. I.

NEUTRALIZING MAGNETISM.

The LARGE SILVER MEDAL *was this session presented to Mr. J. H.* ABRAHAM, *of Sheffield, F.L.S. for his method of Neutralizing the Magnetism which often occurs in the Balance, and other Steel Parts of the Works of Watches. The following communication has been received from Mr. Abraham on the subject.*

Holy Green House, Sheffield,
March, 29, 1826.

DEAR SIR,

KNOWING that the Society for the encouragement of Arts, Manufactures, and Commerce, is always willing to countenance any invention that may be of public utility, I feel pleasure in submitting a discovery in magnetism, which I have no doubt will be found to contribute to both individual and public advantage.

The discovery to which I allude is a method of neutralizing concentrated magnetism in the most minute parts of the steel work of time-keepers, as chronometers, &c. without the aid of heat.

I have been frequently solicited to communicate the discovery for individual advantage only, at a fair price; but as my chief object in all my researches is public good, I prefer communicating the invention to the Society for promoting Arts, Manufactures, &c. not doubting but that the testimony of their approbation will be in proportion to what they consider the value of the discovery to the public.

I flatter myself that the respectable accompanying testimonials will prove satisfactory as to the practibility and utility of the invention.

I am, Sir,
&c. &c. &c.
J. H. ABRAHAM.

A. Aikin, Esq.
Secretary, &c. &c.

Sheffield, March 31, 1826.

It is, I believe, generally understood by those who have not made the science of magnetism a study, that the fluid is *communicated* to steel bars, and other articles capable of possessing permanent active magnetism, by induction, friction with magnetic bars, &c. &c.

In my opinion the very contrary is the fact. All ferruginous bodies possess the magnetic fluid in a latent or inactive state, in proportion to their purity; this fluid may be brought into action and concentrated by various means, as position, friction, percussion, attraction, galvanism, electricity, &c. I believe that attraction is the most general cause of the steel works in time-pieces becoming actively magnetical.

Valuable watches are frequently observed to keep very irregular time, from no visible cause, whilst the works remain in connexion; nor after they are separated, unless the steel works are tested, by plunging them into fine steel filings. From the minuteness and delicacy of those parts of a time-piece which are manufactured from steel, it has been considered by those watch-makers with whom I have conversed on the subject to be almost an impossibility to deprive them of active magnetism by any other means than that of heat.

When a balance or verge has been exposed to a sufficient heat to distribute the fluid, it becomes unfit for further use till hardened and polished, and even then it is frequently spoiled; therefore watch-makers prefer either returning the watch in its magnetic state, or supplying new apparatus, which generally incurs an expense of six or seven shillings in a common watch, and a greater sum in proportion to the value of the works. In attempting to *distribute* (or, according to the general term, *take out*) the magnetism in any part of the steel works of a watch, with a *very fine magnet*, by *touching* it in a contrary direction, or with a different polarity, it must be complete chance if the experiment succeed; since the power applied, and the delicacy of the *touch*, must be in proportion to the activity of the magnetism, and the fineness of the part containing it; for wherever the *finest* magnet last touches any part of a balance, it will leave a small concentration of magnetic power.

With a series of fine and very delicate magnets I always failed in *completely* neutralizing the fluid by the touch. After spending much time without success, I was still determined to surmount the difficulty if possible. Upon studying

the first cause of all my trouble and disappointment, I was led to believe that I very probably might destroy the effect by means similar to those which produced it, and in this I was not disappointed, for the experiment succeeded equal to my expectations. Time-pieces generally become actively magnetical without being brought into contact with the agent that concentrates the fluid; but, according to the laws of magnetism, a contrary polarity will always be found in the part rendered magnetical, to that of the magnet presented to it.

This proves that the fluid is put in motion and concentrated by *attraction;* present the contrary power in the agent (not in contact) to the same part of the machinery, and it will repel or re-distribute the fluid which was previously attracted, and if it be kept in that position the least period of time beyond that which is necessary to neutralize the fluid, it will give contrary polarity to the part subjected to the experiment.

For some time I found a little difficulty in performing the experiment satisfactorily, owing to the invisibility of the fluid; but I was relieved from this difficulty by dipping the apparatus to be experimented upon into fine steel filings, which rendered the situation of the active magnetism visible.

Upon presenting a fine magnet to the part clothed with filings, at the distance of from one inch to a quarter of an inch, according to the power to be neutralized, it will immediately be perceived whether the polarity of the magnet be of the same kind as that in the apparatus; if so, the filings will gradually fall from the part as the power becomes neutralized: when all the filings have fallen from the part submitted to experiment, dip it again into the filings, to prove whether it has acquired opposite polarity,

by remaining too long in the vicinity of the magnet; if that be the case, present the contrary end of the magnet at a distance in proportion to the power to be diffused. Very little practice will enable any person to deprive any part of the steel apparatus belonging to the time-piece of active magnetism in two or three minutes. I can generally perform the experiment in one minute, however magnetical the balance or other part may be that is to be deprived of this concentrated power.

CERTIFICATES.

DEAR SIR, Sheffield, March 28, 1826.

Mr. J. H. Abraham called upon me this afternoon, and exhibited his new mode of neutralizing concentrated magnetism in the fine steel works of watches and other time-pieces. The experiment was repeated many times with complete success, so far as I could judge by the test of steel filings presented on the occasion. If the Society, of which your are Secretary, find it, on examination, as perfect for the purpose intended as it appears to me to be, I doubt not that they will deem the inventor worthy of a honourable testimonial of their respect for his ingenuity and talents, so well, and, I believe, usefully, applied.

I am, Sir,

&c. &c. &c.

J. MONTGOMERY.

A. Aikin, Esq.
Secretary, &c. &c.

16, High-street, Sheffield,
March 30, 1826.

Sir,

Upwards of four years ago, Mr. Ray, of this place, brought me his watch, complaining of its going badly, observing it had not kept time since he allowed a person to stop it by presenting a powerful magnet to it. On taking out the balance, I found it so strongly magnetical as to lift a common sewing needle. As the watch was a valuable one, I declined trying any means to rectify it, as the method I had taken with other watches, having the same fault, was attended with a deal of trouble, and a risk of breaking the balance, and not always successful. Therefore, the shortest way, I advised Mr. Ray to have a new balance put to his watch. Mr. Ray observed, he thought Mr. Abraham, perhaps, might rectify it. Mr. Abraham undertook it, and completely freed it from magnetic power, by a simple and expeditious method, and not attended with any risk or damage to the balance, which must be of great importance to watch-makers and others.

A. Aikin, Esq.
Secretary, &c. &c.

Samuel Snidall,
Watch-maker.

Sir,

Sheffield, March 31, 1826.

About two years ago, Mr. E. Barber, merchant, of Sheffield, applied to me to regulate his watch, which, he remarked, kept time very badly, although it had till lately gone very correctly. Upon examining the parts very minutely, I perceived that the cause was owing to the balance and verge having both become strongly magnetical.

Not being able to deprive the parts of their magnetism without the application of heat, by which means they are very liable to be injured, I recommended Mr. Barber to apply to Mr. Abraham, who, I had been informed, had taken the magnetism out of a balance that was very strongly magnetical, without the aid of heat, or using any method that in the least injured the parts submitted to the experiment. Mr. Abraham returned the verge and balance to me so completely free from magnetism, that they would not attract the least particle of fine steel filings, although, previous to the experiment, they lifted a strong needle.

I consider that the discovery of a method of depriving the steel works of time-keepers of magnetism, without applying heat, will be of great value to the trade, as from some cause new watches are often found to be magnetical before they have been worn.

I am, Sir,
&c. &c. &c.

A. Aikin, Esq.
Secretary, &c. &c.

JOSEPH BROWN,
Watch-maker.

SIR, Sheffield, March 31, 1826.

I feel pleasure in adding my testimony of the correctness of Mr. Brown's statement respecting the magnetical state of my watch. It has gone as regularly since that period (upwards of two years since) as it had done previous to its becoming magnetical.

I am, Sir.
&c. &c. &c.

A. Aikin, Esq.
Secretary, &c. &c.

ENOCH BARBER.

No. II.

MINERS' SAFE LAMP.

The SILVER VULCAN MEDAL *and* TEN GUINEAS *were this session presented to Mr.* J. ROBERTS, *of St. Helen's, Lancashire, for his improved Safe Lamp for Miners; which has been placed in the Society's repository.*

THE only real objection to the use of Sir H. Davy's safe lamp for coal miners, is the inferior degree of light that it gives when compared with that given by a naked candle. This arises from two causes, namely, the necessary obstruction offered by the black wire of which the cage or gauze is composed, within which the lamp is placed, and the casual obstruction occasioned by the adhesion of smoke to the inside of the cage when the lamp is not carefully trimmed, and of smut and dust to the outside of the cage.

To diminish the obscuration occasioned by the first cause, Mr. Roberts proposes that the wire shall be kept bright and polished, by cleaning the cage every night with a soft brush and the black powder or smut which occurs in all coal mines, especially in the neighbourhood of faults: this smut is pulverulent non-bituminous coal, sufficiently hard to remove the rust from the surface of the wire without materially wearing the wire itself.

As the lamp is at present constructed, the oil will run out of the cup or receptacle in which it is placed, if the lamp is laid in a horizontal position, an accident which frequently occurs on account of the lamp being rather top heavy. When this happens the gauze becomes smeared over with viscid oil, which causes the coal-dust floating in the air of the mine to adhere to it, and in a short time to fill up more or less the meshes of the gauze. By merely shaking or tapping the lamp the dust will not be dislodged; and if the miner attempts to clear his lamp by blowing through the wire gauze, he runs the risk of putting out the light, and after all very imperfectly clears the meshes; there is also perhaps some risk of forcing the flame through the meshes on the opposite side, and of producing an explosion, if the surrounding air is imflammable.

In Mr. Roberts's lamp the overflow of the oil is impossible, on account of the dome-shaped cover which surrounds the wick; the dust, therefore, that settles on the gauze, may be dislodged by a mere tap with the finger, or, what would perhaps be better, by the application of a small brush similar to that which soldiers carry to clear the pan of their muskets, and which might be attached by a bit of small chain to the handle of the lamp.

Reference to the Engraving.

Plate II. fig. 6 a section of the lamp *p p*, and wire gauze *q q*; *r r* a screwed cap, with a hollow dome *s*; it screws into the neck *t t* of the lamp: the dome rises a little above the wick-holder *u*, having an opening at top to let the wick

and trimming wire *v* rise through. This dome serves to catch and retain any oil that may spill by shaking the lamp or knocking it over, thereby protecting the wire gauze *q* from being smeared; *w* and *x* two locks, the former to secure the cap *g*, and the latter to secure the wire gauze *q* from being removed.

Fig. 7 a section of the cap and dome *r r s*, separate from the lamp: the wire gauze fits into the cavity *y y*, around the dome *s*; *z z* two of the four wires which serve to hold the wire gauze.

PAPERS

IN

POLITE ARTS.

No. I.

NEW MODE OF APPLYING BLACK LEAD IN DRAWINGS.

The SILVER ISIS MEDAL *was this session presented to Mr.* C. GALPIN, *of Charmouth, Dorset, for his new mode of applying Black Lead in Drawings. Specimens of the same have been placed in the Society's collection.*

Charmouth, Dorset,
Feb. 10, 1826.

SIR,

I BEG the favour of your submitting to the inspection of the Society of Arts, &c. the *drawings* sent herewith, being specimens of a new process of my invention of applying black-lead to the general purposes of drawing; and also the *impressions*, produced by the same material, as a sub-

stitute for copper-plate engraving, and the prevention of forgery.

I am, Sir,

&c. &c. &c.

A. Aikin, sq.
Secretary, &c. &c.

C. GALPIN.

Having, in common with, I believe, all admirers of drawing in black-lead pencil, long regretted that a material of such a natural and pleasing neutral colour should be confined to the tedious process of producing broad gradations of shade, by means of a laborious repetition of lines or touches, I commenced about two years ago a series of experiments, with a view of producing a breadth of touch and effect equal to oil painting, supposing it to be executed in a neutral tint corresponding with the colour of black-lead; but I found, after indefatigable labour, that the granular separation of that material, when applied to paper, rendered it impossible, although I remained satisfied that it would be superior to any other material for the general purposes of drawing if this impediment could be removed: and about two months ago, considering I had only heretofore applied the material in its natural state, I resumed the pursuit, by reducing it to an impalpable powder, and using it with a brush, palette, &c., and the result has been the most complete success, by a process exceedingly easy and simple, by which every possible degree of shade can be produced with the nicest uniformity of tint, when necessary, and in less than a twentieth part of the time required in the ordinary manner, with an apparatus which does not exceed the cost of one shilling, consisting of a small piece of fine muslin, filled with dark black-lead, reduced to fine powder (and tied up similar to bladder colours used by artists),

which I have called a *shader*; a *palette*, made of thick card-board; and a *brush* (such as is used by artists in oil) of medium size.

Process.—The shader is rubbed two or three times on the palette, near one extremity, by which a small portion of the lead is sifted as it were through the muslin; the brush is passed round in the pulverized lead, and on some other part of the palette, to adjust the shade required; the brush is then applied to the paper, to produce a sky or other expanse of shade, with a circulating motion. A sky which before this invention has taken me six or eight hours, I now execute in as many minutes, and with what effect the Society will judge from the drawing marked No. 4, on the top margin.

The sea is produced in those marked Nos. 1 and 2, by the pith of the common elder, the wood of which is cut away so as to expose the pith to the touch, which on being applied to the palette, and then to the paper, produces a beautifully soft and gradual touch. In the tempestuous sea of No. 3, the brush is used after the shades are inserted with the pith.

From the beautifully uniform tint produced by the brush and pulverized lead, I was led so try the possibility of applying it to useful ornamental purposes, by means of the process of stencilling. With what success I have effected this, the Society will judge from the specimens which accompany this communication.

The figures or patterns are cut out in thin card; one of these being laid on the paper, the brush, previously charged with black-lead, is passed over it with a circular motion, and an impression, or rather copy of the figure, is produced.

Complicated ornaments may be produced by the successive application of two or more figures on the same ground, or by moving the pattern a little, and then producing a second copy, which will mingle with and modify the first. Both these methods even might be combined, if a very complicated figure, difficult of imitation, was wanted.

I beg particularly to remark to the Society, that my principle of producing skies can be adopted by any without interfering with their general style of drawing, and is so exceedingly easy that a novice cannot fail of producing a tolerable effect. I have received several applications from amateurs (who have presumed I used Indian ink), to ascertain how I produced my skies so rapidly, but I have not yet communicated my process to any individual, from the hope that the Society will so far consider my invention an acquisition to the arts as to give it a place in their volume of Transactions, and I beg leave to add; that it would be highly gratifying to my feelings to have it first made public through so distinguished a source; and I shall feel happy to give the Society any further information on the subject.

C. Galpin.

Sir, Charmouth, March 11, 1826.

I beg permission to inform you, that since I communicated to your Society my process of drawing in black lead (which you did me the honour to inform me was referred to the consideration of a committee), I have discovered that common powder black-lead fully answers the purpose; and trusting such a step may not be irregular, I have sent a few specimens, drawn with common lead in powder, such

as is used for domestic purposes, together with a specimen of my drawing a few months previous to discovering my new process, which, with a few observations on the materials before described, I will thank you to cause to be placed in the portfolio containing my first specimens, for the inspection of the Committee, and you will additionally oblige,

Sir,

Your's, &c.

C. GALPIN.

A. Aikin, Esq.
Secretary, &c. &c.

SIR, Charmouth, March 29, 1826.

I beg leave to inform you, that since I last took the liberty of addressing you on the subject of my application of pulverised black lead to the purposes of drawing, &c., it has been applied in the delineation of architecture and figures with such singular success, that I am induced to trouble you with a few additional specimens for the inspection of the Committee, when it comes under their consideration, which I will thank you to be caused to be placed in the folio containing my former specimens.

The device of "Hercules encountering the Hydra" was intended to have been engraved on copper-plate, and one hundred copies were required, which I have supplied with black lead, with the most complete satisfaction.

In architecture it has proved exceedingly useful in producing a number of copies of the same moulding for cornices, required to be put into the hands of different workmen, which matched with the utmost precision when brought together in the course of building. In any number of copies of

sections it is impossible there can be the least variation, and the sharpness with which the outline is defined renders it particularly applicable to this purpose.

I have supplied two architects of this neighbourhood with sections of mouldings and architectural ornaments, at the rate of four copies per minute, with common black lead.

I think I omitted to mention, that the common black lead is ground in water on a stone in the manner of ordinary paint, dried before the fire or in an oven, and again reduced to powder in a mortar, then tied up in muslin as described in my first communication: in the space of ten minutes a sufficient quantity may be prepared to supply the constant application of three months.

I beg leave also to add, for the information of your Committee, that since my first communication to your Society (viz. about the 10th of February) I have drawn forty views, seventeen architectural elevations, and taken off more than three hundred impressions, without having used two pennyworth of black lead.

Trusting I have not committed an impropriety in again troubling you with specimens,

I beg to remain, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. C. GALPIN.

SIR, Charmouth, May, 12, 1826.

Permit me the honour of requesting you to be the medium of conveying to the Society of Arts, &c. my most grateful thanks, for the distinguished mark they have been

pleased to bestow of their approbation of my mode of applying black lead in drawings.

I have also to beg that you will do me the favour of stating my perfect acquiescence in the conditions which are contained in your letter of the 5th instant, and I have the pleasure of adding a full description of my process.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. C. GALPIN.

The materials used by me in executing drawings in black lead are three brushes, made of badgers' hair, similar to those used by painters in oil-colours, and denominated softeners, except being only one-third of the length of ordinary softeners in the hair; the largest brush is one inch in diameter, the second three-eighths, and the smallest one-eighth of an inch in diameter. A palette of ordinary size, made of thick card paper. The pith of common elder tree, dried naturally*; and two small muslin bags, filled with pulverized black-lead†.

* The pith used by me is that of the most luxuriant saplings of the common elder tree, which decay and become dry naturally, and may be collected during the months of January and December. The thin wood in which the pith is inclosed answers the purpose of a portcrayon in using it.

The idea of applying this material to the purpose in question suggested itself to my mind whilst seeing an electrical experiment with figures cut out of the same material, and which I found to possess all the necessary qualities which I had been for a long time seeking in vain.

† The best dark black lead is merely reduced to fine powder, and placed in the muslin; but common black lead requires to be

If the drawing is intended to have a marginal termination, a frame of thin card-paper is placed on the paper or card which is to receive the drawing, to protect the margin and determine the size and shape of the same; but if the drawing is intended to have a vignette finish, no frame is required. To proceed with the sky, the bag containing the pulverized lead is passed two or three times over a part of the palette, when a small portion of the lead will be sifted through the muslin; the largest brush is applied to the leaded part of the palette, and then to the drawing, beginning at the top, and proceeding to the horizon with a light circular motion, when a beautifully delicate shade will be produced; the clear expanse is first done, leaving the lights for clouds, if any are intended to be introduced, the dark parts of which are done by charging the brush with more lead from the palette: in exceedingly delicate skies the brush should be passed two or three times over the unoccupied part of the palette, to adjust and regulate the tint before applying it to the drawing.

Skies, distances generally, smoke, smooth water, and accidental vapour, are produced and finished with the brushes alone; and the intervention of atmosphere in the distance is given by the largest brush passing over the whole, slightly charged with lead. Every expanse of dark, of whatever degree, is then brushed in, and the particular characters of surface, texture, &c., of objects given by the pith where it applies, which, being cut in a shape favourable to

ground in water on a stone (in the manner of ordinary paint), dried and pulverized, when it is put in muslin for use. The common lead is used in the darkest, and the best lead in the lightest parts of the drawing, at the discretion of the performer.

the particular touch required, is applied to the palette in the same manner as the brush, when a portion of the lead is taken up in its pores, which on being applied to the drawing is gradually given out, producing a natural uniform touch, which may be repeated several times when a succession of such touches is required, without being again applied to the palette. Agitated and tempestuous sea is executed entirely with the pith, and the aerial indistinctness of distance given by the brush.

Objects near the foreground, requiring a particular sharp or rough character, in addition to the shading produced by the brushes, are finished with a black lead crayon over the shading previously brushed in. Where a particularly abrupt termination is required to a shade, a piece of card of a suitable shape is held in the left hand on the drawing during the operation of the brush, to protect the light and give the required sharp finish to the shade.

When a number of copies of the same subject are required, the definite shades are produced first, with the brushes, through corresponding apertures cut in three or four guides, made of thin card, of the precise size of the drawing, beginning with the darkest, and including the last in each succeeding guide: the apertures in the guides comprise the principal masses of shade, and the lights are protected by the intervening parts. Particular care is taken not to shade too close to the boundary of any aperture in the guides (except a sharply defined outline be required), by which the harmony and consistency of the whole would be interrupted in the finish.

The principal masses of dark having been brushed in through the guides, the marginal frame is placed on the

drawing, which next receives the sky and finishing with the brushes, &c., as first described.

C. GALPIN.

P. S. This statement contains several trifling improvements since my communication to the Society, particularly the use of three brushes.

The Society will please to retain any of the specimens in their possession which they may think proper.

No. II.

ELASTIC MOULDS FOR CASTING IN.

The LARGE SILVER MEDAL was this session presented to Mr. DOUGLAS FOX, of Derby, surgeon, for his Elastic Moulds for Casts in Wax or Plaster of Paris. The following communication has been received from the Candidate on the subject, and specimens of his casting have been placed in the Society's collection.

SIR, Derby, April 5, 1826.

IF you would have the kindness to transmit the inclosed paper, together with the specimen, cast in plaster of paris, to the Society for the encouragement of Arts, Manufactures, and Commerce, you will much oblige,

A. Aikin, Esq. Sir, your's, &c.

Secretary, &c. &c. DOUGLAS FOX.

Description of making Elastic Moulds of Glue.

Having been much employed in taking casts of anatomical preparations, I frequently met with specimens, principally of hard substances, that did not admit of moulds hitherto employed being removed from them. This arose from any given specimen of such description having various portions of it with considerable overlaps; that is, there were hollows, or undercut parts, from which no mould could be withdrawn without its being injured.

Although in many instances soft clay, or soft wax, may be used to take impressions, still these, in numberless instances, cannot be removed from the body to be moulded without being injured in those parts which were pressed into the hollows; to overcome these difficulties, it appeared evident that if an *elastic* substance could be substituted for the soft clay, or wax, the moulds might be withdrawn uninjured, by giving way during the removal from the undercut parts of any such body, and also that the moulds would afterwards return to their proper forms again. To effect this I have made use of glue, which has answered perfectly, employed as follows:—

The body to be moulded, previously oiled, must be secured one inch above the surface of a board, and then surrounded by a wall of clay, about an inch distant from its sides, the clay must also extend rather higher than the contained body; into this, warm melted glue, as thick as possible, so that it will run, is to be poured, so as to completely cover the body to be moulded; the glue is to remain till cold, when it will have set into an *elastic* mass, just such as is required.

Having removed the clay, the glue is to be cut into as many pieces as may be necessary for its removal, either by a sharp pointed knife, or by having placed threads in the requisite situations on the body to be moulded, which may be drawn away when the glue is set, so as to cut it in any way that may be desired; the use of these threads need not be more fully explained, as the method is generally known to persons in the habit of casting.

The portions of the glue mould, having been removed from the original, are to be placed together, and bound round by tape.

In some instances it is well to run small wood pegs through the portions of glue, so as to keep them exactly in their proper positions. If the mould is of considerable size it is better to let it be bound with moderate tightness upon a board, to prevent it bending whilst in use; having done as above described, the plaster of paris, as in common casting, is to be poured into the mould and left to set.

In many instances wax may also be cast into glue, if it is not poured in whilst too hot, as the wax cools so rapidly when applied to the cold glue that the sharpness of the impression is not injured.

I have stated glue as succeeding well where an *elastic* mould is alone applicable; but many modifications are admissible. Where the moulds are not used soon after being made, treacle should be previously mixed with the glue (as employed by printers), to prevent it becoming hard.

The description thus given is with reference to moulding those bodies which cannot be so done by any other than an *elastic* mould; but glue moulds will be found greatly to facilitate casting in many departments, as a mould may

frequently be taken by this method in two or three pieces, which would on any other principle require many.

DOUGLAS FOX.

The specimens accompanying Mr. Fox's communication were casts of a deer's horn, and of a calculous concretion, very rough and tubercular on the surface. The Committee considered it desirable to have before them also a specimen of a cast from some soft anatomical preparation, and accordingly directed the Secretary to make known their wish to the candidate. This was done, and produced the following additional communication, accompanied by a cast from a fœtus, as described in Mr. Fox's letter.

Derby, May 13, 1826.

In compliance with the request of the Committee, I have, by means of a glue mould as before described, made a cast of a deformed fœtus, which has been preserved many years in spirits; the skin has become extremely wrinkled, flaccid, and tender, so that no substance but such as was yielding could have been applied, and again removed, without injuring the original. By making the mould of an *elastic*, or yielding material, this point has been completely obtained.

Even supposing the fœtus could have been moulded as usual, either by plaster of paris in many parts, or by pressing clay, or soft wax, upon it, the operation was performed with one-tenth of the trouble by the glue mould; but the original would not allow of a hard unyielding substance, like plaster of paris, being removed, without injur-

ing it; nor would it bear the pressure of clay, or soft wax, sufficiently to take an impression. I therefore am well convinced, no plan but an *elastic* mould could have been employed to procure a cast of the fœtus without injuring it, as it is in so tender a state.

But it is not in making casts from soft substances that I consider the *principal* advantage of moulding in glue consists, although in this department it is highly advantageous, and will take some preparations of this kind, which cannot be done by any other means. The great difficulty in casting is to be able, where it is required, to make a mould which will deliver where there are undercut parts, or hollows, or where there is what is called a dove-tail; now this can only be effected by means of an *elastic* mould, and I have found nothing better for that purpose than glue, as before described. I am well aware that soft wax has been long employed to form moulds upon hard bodies; but where there are several undercut, or hollow parts, or parts that project in the subject to be moulded, the wax not being *elastic* cannot return accurately to its proper position when removed from the body. More fully to explain this, I have made a cast of a calculus, which could not possibly have been produced by any other mode than that of having an *elastic* mould; soft wax could not have been removed from the undercut parts without having its form injured; now the glue gives way whilst being removed, and returns to its former position, or shape, when so removed, which enables the parts to be accurately represented.

I therefore consider the principal advantage of my plan to consist in the moulds being *elastic*, and consequently capable of removal from hollows, and undercut parts, by giving way, and again returning to their proper forms.

This great desideratum in casting cannot, in numberless instances, be obtained by any other means. The glue moulds are also, in common instances, much more expeditiously employed than others.

The fœtus having been oiled, was surrounded by two silk threads previous to the glue being poured upon it, so that when the threads were drawn out they cut the mould into three pieces; the situations of these divisions are seen by the seams left upon the preparation. This being done, the elasticity of the glue allowed every part to be removed without the slightest injury. There is no novelty in using thread, as here described.

The mould of the calculus was merely cut into two parts, which allowed each half to be removed from the stone; they being again placed together, were ready for use, that is, for the plaster to be poured in.

No. III.

IMPROVED SLIDE TO THE RULING MACHINE USED BY ENGRAVERS.

The LARGE SILVER MEDAL *was this session presented to Mr.* W. PALMER, 18, *Clifton-street, Finsbury, for his improved Slide to the Ruling Machine used by Engravers. The following communication has been received from him on the subject, and one of his slides has been placed in the Society's Repository.*

18, Clifton-street, Finsbury-square.

SIR, March 18, 1826.

CONSIDERING that the ruling machine is of as much importance to engravers, and the advancement of their art, as the steam-engine is to the manufacturer, I venture to call the attention of the Society of Arts to an improvement which I have made in that part of the ruling-machine called the slide and carriage, which, I trust, will be found to surpass all others for durability, freedom, and simplicity, and also for economy.

The truth of those which are used at present depends upon springs, and for their freedom upon friction rollers. These are parts which appear to me highly objectionable, where a steady, regular, and uniform motion, is absolutely necessary; the springs being more or less affected by temperature, and subject to relaxation from the constant

pressure that is upon them; and friction rollers, by multiplying the action and dependencies, each becomes a source of error. My object has been to avoid these evils, by simplifying the machine as much as possible, and to construct one upon such a principle that the bearings should be natural, and always inclined to keep in order by their own action. It affords me pleasure to state, that the following artists, viz. Mr. Turrell, Mr. Bacon, and Mr. Lowry, have expressed their approbation of my slide, and that I have found it answer to my perfect satisfaction, after many months' practice.

I am, Sir,
&c. &c. &c.
WM. PALMER.

A. Aikin, Esq.
Secretary, &c. &c.

P.S. The principle of my slide is that of leverage; the carriage slides upon a cast iron *v* surface, which forms its prolonged centre of motion; on the left of this is a small projecting piece of brass, attached to the carriage, and kept up against an over-hanging straight edge, by means of the weight on the opposite side, which weight acts as a lever, and will follow up and make good any inaccuracies occasioned by friction and frequent use. By this slide lines of various lengths may be ruled; and though continued use will impair the straight edge, yet the imperfection will not be visible, for as you begin a plate so you must end it, the leverage being always the same, and the bearing always uniform.

The price of a slide thirty-six inches long, made upon the old principle, the maker says will cost 20*l.*; and I should be happy to make one of the same length upon my method for 7*l.* or 8*l.*

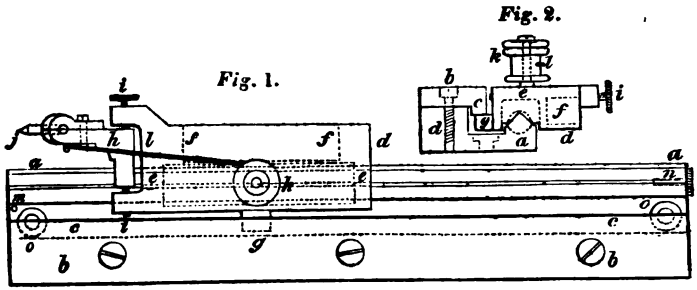


Fig. 1 is a bird's eye view, and fig. 2 an end view of the slide; *a a* the ruling bar, made angular like the off bar of many of the iron lathe beds; a strong iron bar *b b*, having a straight under surface along *c c*, is screwed on the iron bed *d* (which is in one piece with the bar *a*), and adjusted so as to be perfectly parallel with the angular surface *a a*; *d d* the carriage; it is cast hollow on the under side, over the bar *a a*, as shown by the dotted parallelogram between *e* and *e* fig. 1, so that only the two ends *e* and *e* touch the bar, and are notched so as to fit and slide freely along it; in the end view, also, the dotted lines under *e* show the hollow; another hollow *f f* may also be cast (at the will of the workman) to be filled with lead, which increases the overhanging weight. A piece *g* projects from the middle of the carriage, and is made flat on the top to slide against the under surface *c c* of the bar *b*, so that the carriage has three bearings, the one *g* upwards, and the two *e e* downwards, the weighted side *f f* keeping the bearing *g* always in contact with the under surface of *c c*, on which it slides; *h*, fig. 1, the swinging arm, *i i* its two centres, and *j* the etching point, *k* a roller knob, by which the carriage may be moved along the bar, and by turning it, the string *b* raises the etching point so that it may be slid back again

to rule the next line; a pin *m* prevents the carriage from coming off at one end, and a screw *n*, put in after the carriage is slid into its place, stops it from coming off at the other; *o o* two holes by which it is screwed to its place for use. This carriage cannot be knocked off by any accident, or tilt over to damage the plate, as when in use it is as low as it can come, and it cannot be taken from its place without removing the screw *n*. As the surfaces of copper-plates are not perfect planes, and may also be a little out of parallelism with the ruling bar, it becomes necessary to make the swing centres *i i* correctly at right angles to the ruling bar *a a*, and also horizontal or parallel with the copper plate, then the little variations in the surface of the copper will not produce any difference in the distance of the lines; but if the centres *i i* were not at right angles, every inequality in the copper would produce a corresponding difference in the distance or straightness of the lines.

No. IV.

BITING-IN ON STEEL PLATES.

The GOLD ISIS MEDAL *was this session presented to Mr. W.* COOKE, *Jun.* 5, *Seymour-street North, Clarendon-square, for his improvements in Etching on Steel Plate. The following communication has been received from him on the subject.*

5, Seymour-street North, Clarendon-square,
December 21, 1825.

SIR,

As the Society of Arts have given a portion of their attention to the subject of engraving on steel plates, and as many experiments have failed, I feel great pleasure in making the following communication public through the medium of the Society.

For the best mode of biting-in, hitherto published, we are indebted to the great perseverance of Mr. Turrell; but the difficulty and danger of using his menstruum on a soft ground, or when the varnish is not sufficiently dry, induced me to use the acids in different proportions, and to leave out the alcohol, as the composition was found to act on the ground, causing the whole surface of the plate to be corroded; this has frequently happened.

It is necessary to mention, that all plates for landscape engraving should be made of steel, not completely decarbonized.

I beg to submit a few preparatory directions previous to etching.

The steel should be carefully cleansed (before laying the ground) with turpentine only, omitting the whiting which is used in preparing the surface of copper.

The ground should be laid with as little heat as possible, steel needing not so much as copper; too high a temperature decomposes the ground, and occasions it to produce small air bubbles, or to evaporate in a light smoke from the surface of the plate; should this take place, the ground must be re-laid. It is also highly necessary that in etching the point should penetrate the surface of the steel, and the breath not be suffered to condense on the etching, as it will cause the lines to rust, and will prevent the acid from biting well. The plate being ready for biting-in, the process is as follows:—mix, by gentle shaking, six parts of acetic acid, and one part of nitric acid.

This mixture, being very rapid in its action, should be taken off the plate at half a minute, and the acid well washed out of the lines with water, drying the plate well, but without the assistance of heat. Stop out the light tints with Brunswick black varnish; and then, for the purpose of washing the oxyd out of the lines, pour on the plate a mixture of six parts of water and one of nitrous acid, letting it remain two or three seconds; take this off, and immediately repeat the former mixture without washing the plate between with water. This process should be repeated for each tint.

The biting-in of a steel plate should be accomplished, if possible, in one day: this observation holds good in regard to other methods of biting, as the lines will sometimes attract oxygen from the atmosphere during the night,

which will prevent their biting with the same degree of clearness as the day before.

When the biting is completed, and the ground taken off, with a strong tooth-brush and turpentine, clean out the remaining oxyd from the lines, using the fingers for the light tints; then rub the surface of the plate, to remove the bur, with the finest emery paper previously well used on the back of a steel plate to take off its roughness; the more this paper is used the more valuable it becomes for taking out the marks of the scraper from dry point tints.

Re-biting is performed by dipping a clean rag in a very dilute nitric acid, and rubbing it over those parts intended to be re-bitten until the surface becomes dull; clean the plate out as before-mentioned, and in laying the ground the dabber should be used but little, as it is likely to take up the ground again; re-bite with a few drops of nitrous acid in four ounces of water, sufficient to make the water taste sharply of the acid.

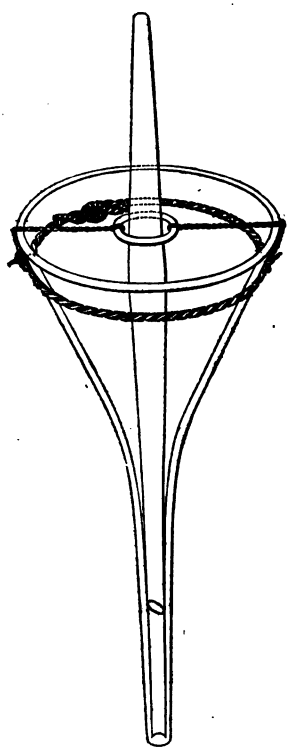
The whole process for biting, or re-biting, should be performed in a temperature of about sixty degrees, or higher, and certainly not much below that point.

As the time required to bite-in is the principal thing to be observed, all the light tints should be tried every minute after the first biting; but the deeper ones will require a longer time. A little practice will show these remarks (apparently trifling) to be important.

Biting on very soft steel plates may be accomplished by using the following mixture:—three ounces of warm water, four grains of tartaric acid, four drops of nitric or sulphuric acid, one drachm of corrosive sublimate.

I also submit to the Society a new method of gradating skies and other tints.

Incline the plate, by tilting it with a wedge, and pour the re-biting acid into a glass funnel with a stick inserted in the tube, and kept steady by a twisted cord and ring, as shown in the figure below; drop the acid on the dark part, and according to the colour of the tint the acid should be made to drop faster or slower, which is regulated by the stick in the centre, and gives to the acid a tremulous motion, until it is floated over the whole sky; this obviates the old method of sweeping or feathering, which, from the quick action of the acid, occasions streaks to appear in the tints when the ground is taken off.



It is important that engravers should make use of the best acids, and perfectly free from adulteration. From the cheapness of sulphuric acid it is sometimes used with muriatic, to adulterate the nitric acid. The following tests will discover them:—dissolve a little nitrate of barytes in distilled water, and add it to a small quantity of the nitric acid in a phial or test tube; if a white precipitate is discovered at the bottom sulphuric acid is present; and muriatic acid will form, with a solution of nitrate of silver, a white cloudy precipitate; should either of these effects take place, the acid is not fit for use.

The purest acids are those manufactured by Mr. Remnant, Smithfield-bars, who has made them some years for the use of engravers.

Since writing the foregoing account, I have discovered means of making the ground adhere to the surface of the steel, without using acid to dull the surface.

Dissolve, by gentle heat (in a Florence flask), some powdered copal in oil of spike lavender, and evaporate to a thick consistence; then to one ball of ground add about one drachm of the copal solution, each having been made warm previous to mixing; lay the ground as before mentioned, avoiding too much heat; the ground may then be laid with the same facility as on copper.

I am, Sir,
&c. &c. &c.
W. Cooke, Jun.

A. Aikin, Esq.
Secretary, &c. &c.

The above processes were performed on tinted steel plates in presence of the Committee of Polite Arts, to their entire satisfaction, and that of several engravers, who were specially invited to witness them.

No. V.

MENSTRUUM FOR BITING-IN ON PLATES OF SOFT STEEL.

The GOLD ISIS MEDAL *was this session presented to Mr.* W. HUMPHRYS, 65, *Charlotte-street, Rathbone-place, for his Menstruum for biting-in on Plates of soft Steel. The following communication has been received from him on the subject.*

65, Charlotte-street, Rathbone-place.
April 19, 1826.

SIR,

I HAVE a communication to make to the Society for the promotion of Arts, Manufactures, and Commerce, of a menstruum for biting-in steel plates. I have for some time back communicated it to various artists, to get their opinion of its merits, and have the testimony of Messrs. Turrell, W. Finden, &c., that it is the best, cheapest, simplest, and safest in its operation of any acid yet discovered; and those gentlemen will be happy at any time to meet a committee to explain its qualities. In addition, I have specimens of its performance from several engravers to lay before the society.

I am, Sir,
&c. &c. &c.
WM. HUMPHRYS.

A. Aikin, Esq.
Secretary, &c. &c.

The composition of the menstruum is as follows:

Take a quarter of an ounce of corrosive sublimate powdered, and a quarter of an ounce of alum powdered, and dissolve them in half a pint of hot water.

Directions.—Let it cool before use. While using it, keep it stirring with a camel's hair brush, and take care to wash the plate perfectly after each biting. As this acid, though clear before use, becomes turbid during its action on the steel, it may be prudent, in fine works, to throw away each portion of acid after it has been on the plate. The taste and experience of the artist must dictate the length of time he may leave it on his plate; delicate tints are obtained in about three minutes.

It appears from the experience of those artists who have practised engraving on steel, that several of the menstrua employed in the process technically called biting-in, will succeed with hard steel, but give results by no means so satisfactory when employed on very soft or nearly decarbonized steel. Nitric acid is the essentially active ingredient in all these menstrua; and the chemist well knows that when this substance is brought in contact with iron, it usually brings part of it to the state of protoxid, which is soluble in the acid, and also reduces a smaller portion to the state of peroxid, which remains, for the most part, undissolved, adhering to the surface of the iron, and thus preventing that deep, clean, uniform biting which it is the great object of the artist to obtain. The presence of carbon, in a finely divided state, has a tendency to prevent, or at

least to retard, the peroxidation of the iron, and this, probably, is the reason why it is less difficult to gain a good result with hard than with soft or decarbonized steel.

The composition employed by Mr. Humphrys contains no nitric acid; and, from the testimony before the Committee of Mr. W. Finden, Mr. Warren, Mr. Romney, and others, who have tried it; and also from the result of experiments made in presence of the Committee, appears to be superior for biting in on soft steel to any menstruum that has hitherto been used.

No. VI.

DRAWING PEN.

Bryan Donkin, Esq., one of the chairmen of the Committee of Mechanics, having procured in France a drawing-pen, which appears to possess some advantages over those made use of in this country, presented it to the Society. The instrument itself has been placed in the repository, and the subjoined figure and description of it are published for the advantage of English artists.

Fig. 1.

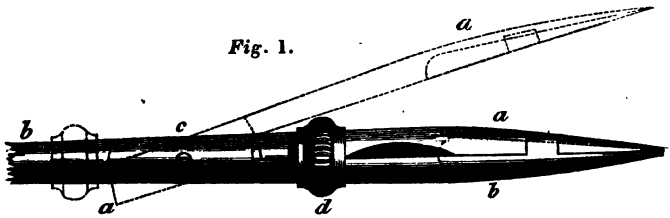


Fig. 2.

Fig. 3.

Fig. 1 represents the drawing end of the pen, twice as large as the original; the two parts *a a* and *b b* are jointed at *c*, and held together by the sliding-ring *d*; the dotted lines *a a* show how that part opens, and thus allows the pen to be charged with ink.

Figs. 2 and 3 show the parts *a* and *b* separated; each part has a corresponding cavity *e e* to hold the ink, the channel being as small at the point as the line the pen is intended to draw; two studs *f f* fit into corresponding notches *g g*, and keep the points accurately together.

No. VII.

ETCHING ON IVORY.

The sum of FIVE GUINEAS *was this session presented to Mr.* J. CATHERY, *6, Hyde-street, Bloomsbury, for his mode of Etching on Ivory, a specimen of which has been placed in the Society's repository.*

THE usual mode of ornamenting ivory in black, is to engrave the pattern or design, and then to fill up the cavities thus produced with hard black varnish. The demand for engraved ivory in ornamental inlaying, and for other purposes, is considerable, although the price paid for it is not such as to encourage artists of much ability to devote themselves to this work, which consequently is trivial in design and coarse in execution. Mr Cathery's improvement consists in covering the ivory with engraver's varnish, and drawing the design with an etching needle; he then pours on a menstruum composed of one hundred and twenty grains of fine silver, dissolved in one ounce measure of nitric acid, and then diluted with one quart of pure distilled water. After half an hour, more or less, according to the required depth of tint, the liquor is to be poured off, and the surface is to be washed with distilled water, and dried with blotting paper; it is then to be exposed to the light for an hour, after which the varnish may be removed by means of oil of turpentine. The design will now appear

permanently impressed on the ivory, and of a black or blackish brown colour, which will come to its full tint after exposure for a day or two to the light.

The property which nitrate of silver possesses, of giving a permanent dark stain to ivory and many other substances has been long known; but Mr. Cathery has the merit of having advantageously applied it in a department of art in which it is likely to be of considerable service by improving the quality of the ornament, and at the same time of diminishing the cost. Varieties of colour may also be given by substituting the salts of gold, platina, copper, &c. for the solution of silver.

PAPERS

IN

MANUFACTURES.

No. I.

BRITISH LEGHORN.

The attention which the Society have given to the manufacture of plat from whole straw, in imitation of that made in Tuscany, and commonly known by the name of Leghorn, may be estimated by referring to their printed Transactions, especially during the last four or five years. The premiums offered have attracted many claimants, and the specimens left in the Society's possession, by those to whom rewards have been bestowed, will show the progress already made, and still advancing, in this important art,—important, both on account of its extent, and because, being a domestic occupation, it is free from the objections which so strongly attach to congregating in factories children and young persons removed from the control and inspection of their parents, and also because it is not very likely that the

occupation thus offered to manual labour should be superseded by the substitution of machinery.

It appears now to be satisfactorily ascertained, that there are few, if any, of our wild native grasses which are applicable to the art of platting, on account of the brittleness of their stems, and the unevenness of the colour. Spring wheat, as it is the material actually used in Italy, so it appears to be decidedly superior to any other material of English growth. In the Islands of Orkney, however, and on the western coast of Scotland, rye has been employed with great success, and the preference due to one material or the other will probably much depend on local circumstances.

The specimens sent in during this session were superior, generally speaking, to those of former years, in greater evenness of colour and of platting, so that, in more cases than one, it was by no means easy to distinguish between these and real Leghorns of equal fineness; and it is quite certain, that during the last spring and summer, many hundred hats and bonnets of British manufacture have obtained a very ready sale as genuine Italian. It only now remains for the ladies of England to bestow upon the works of their laborious, deserving, but suffering countrywomen the patronage to which they are fairly entitled, and in a few years this very desirable manufacture may be secured to the country.

The *silver Ceres medal* or *ten guineas* being the premium offered, was awarded to Mr. *Long*, of Barham House of Industry; and among the other candidates, the following were selected as deserving of the annexed premiary rewards, viz.

To *George Manwaring*, of Benenden, near Cranbrook, *ten pounds.*

To *Frances Cobbin*, of Bury St. Edmunds, *eight guineas.*

To Mrs. *Ingledon*, of Aldborough, in Yorkshire, *five guineas.*

The premium of the *silver Ceres medal* or *ten guineas*, for plat in imitation of Leghorn, made from English straw, was awarded to Mr. *J. Horne*, Jun., of Kenninghall, in Norfolk.

The following letters have been selected for publication, as showing the progress which the manufacture is making, and containing other interesting particulars.

Hemsted-place, near Cranbrook, Kent,
February 3, 1826.

SIR,

The bonnet which accompanies this letter was made in the course of last month by George Manwaring, of this parish (Benenden). This young man has been for years a cripple in his legs, and has been principally supported by the parish; but having applied himself very diligently to the manufacture of straw plat hats and bonnets after the Leghorn method, he is now superintending a school in this village, containing nearly thirty poor girls, from seven to thirteen years old, who are making great progress in acquiring this manufacture.

This bonnet is presented to the Society precisely as it comes from the manufacturer's hands, neither bleached, stiffened, pressed, or coloured in the least degree; and it is made entirely from the common English red wheat straw,

which I grew on my own farm for this purpose. I sowed a quantity of *tail* wheat, in the proportion of seventeen bushels to the acre last Michaelmas, cut and harvested it, after the Florentine manner, in June; and without any other preparation, G. Manwaring platted and formed this bonnet. The present fashion would, perhaps, have required the brim of it to be wider, but he was apprehensive of losing the opportunity of offering himself as a candidate for any reward which the Society may think his production deserves.

I am, Sir.

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOS. LAW HODGES.

P.S. I prefer sowing tail to head grain, as more seed is contained in the same measure, and it consequently comes up finer. I have this year a quantity now coming up, sown after the rate of twenty bushels to the acre, and which I anticipate will be much finer than that of last year.

Barham House of Industry, near Ipswich.

SIR, January 30, 1826.

I respectfully beg leave to send with this letter a bonnet manufactured by me at the Barham House of Industry. It is made from spring wheat straw of last year's growth (1825), from land in the parish of Claydon, near Ipswich. I grew *eight* acres of the wheat-straw from which this bonnet was made. I am preparing ten acres for the same purpose this year, and if the weather prove auspicious for harvesting the straw, I shall employ at the end of this year

at least five hundred hands in this manufacture. The bonnet now sent is manufactured without either pressing, bleaching, or any other process, and is in the state in which it came from the knitter's hands.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOSEPH LONG.

Kenninghall, Norfolk,

SIR, February 2, 1826.

Herewith you will receive upwards of fifty-two score of plat, manufactured from spring-wheat, grown at Kenninghall in the county of Norfolk, by me. I humbly put in my claim for the premium offered by the Society of Arts, &c. for the above quantity, produced according to the directions in the Society's publication for 1826. I flatter myself it will be the best that will be produced to the Society, as it knit up very handsome. It is all of it just as it came out of the field, neither cleaned nor bleached, except two small parcels that are bleached, and which I have specified on the labels. I have likewise sent two small parcels of the unmanufactured straw, one parcel is bleached, and the other not bleached. The land it was grown on I find is particularly suitable; it is a very stiff, clay soil, and produces the material fine, both in colour and size, and solid or firm, so that it stands well to the pressing; in short, I presume, if you compare it with the foreign, you will perceive they are exactly alike. I am employing a great many hands in the business, who would otherwise be on the parish for a livelihood. I am a poor man, and should

I be fortunate enough to obtain the premium offered, it will materially assist me to prosecute it with effect. Should you require a confirmation of what I have stated, I can very easily obtain it from many most respectable persons.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN HORNE, JUN.

Messrs. Muir, of Greenock, also sent a parcel of hats, which, from not arriving in time, could not (consistently with the Society's regulations) be admitted in claim of the premium.

On examination, the samples proved to be remarkably even in colour, and very well platted; the material (rye straw) is very tough; and, according to the judgment of persons largely employed in London in the sale of Italian hats, those of Messrs. Muir's manufacture are quite equal to Leghorn.

The *large silver medal* was awarded to Messrs. *Muir*.

The following is the communication received from them on the subject.

SIR, Greenock, Feb. 28, 1826.

In reply to yours of the 24th February we have to say, that we continue to use the straw of the rye only, and have not adopted any other material. There is not at present any house where our hats are sold. The greater part of what we make are maid's sizes; they bring the same duty; we can produce them of better value. We intend in a few days to forward some of them to Messrs.

Welsh, Gregory, and Cubit, and Blackmore, Swan, and Co., London.

We are, Sir,

&c. &c. &c.

A. Aikin, Esq. JAMES & ANDREW MUIR.

Secretary, &c. &c.

SIR, Greenock, February 10, 1826.

Some of the members of the Highland Society, Edinburgh, having solicited our information on the subject of manufacturing straw hats in imitation of Leghorn, our A. Muir met yesterday with the committee in their chambers, Queen-street, and produced samples of straw, plat, and hats, in imitation of Leghorn hats. He also laid before them a few hasty drawn up remarks, a copy of which we hand you, with samples of our manufacture, for your inspection. We did not think of entering into further competition before the London Society, though we think none have made greater progress in the manufacture than ourselves; perhaps the Society of Arts may think well of our hint, as it respects giving small premiums to the operatives, that is, the platters and knitters of the hats. A large proportion of the female population of Orkney is now engaged in that kind of manufacture, and to women who do not earn more than from eight to twelve pounds a year, a few premiums of one to two guineas distributed annually would add to the comforts of those who receive them, and prove a general stimulus to cleanliness, which, we think, is much wanted in the manufactory. And perhaps the manufacture may be still improved, if wheat straw could be raised as fine as the rye, and of a similar colour.

We have herewith sent you a sample of the top joints of our rye as it is given out to the platters; and three pieces, thirty yards each, of our finest plat, neither of which has undergone any bleaching since the straw was brought from the field; the hats are as from the needle, but the plat was bleached before knitting. We have also sent samples of wheat straw hats, split and knitted in imitation of whole straw. They will make beautiful light bonnets, and show what might be done with the wheat straw, but they are more expensive than the rye straw. We have enclosed a note of the prices, in case any of the members of the Society wished to purchase. You see the flats are twenty-four inches in place of twenty-two, the foreign size; we cut the flats in two, and with another crown make two hats.

We are, Sir, &c. &c.

A. Aikin, Esq. JAMES & ANDREW MUIR.
Secretary, &c. &c.

REMARKS BY J. AND A. MUIR ON THE MANUFACTURE OF PLAT AND HATS IN IMITATION OF LEGHORN.

In summer, 1823, our attention was directed to the manufacture of straw hats in imitation of Leghorn; we that year made hats from the common rye grass, the crested dogs'-tail, and the sweet scented vernal, neither of these grasses, when made up into hats, had that appearance as to encourage our persevering with them. We also made trial of wheat straw, and the rye that produces grain, we have not been able to raise wheat sufficiently small in the op joint as to make hats.

In 1824, we purchased from Mr. Cobbett a quantity of his foreign wheat, which he advertised as being the very same as that grown by the Leghorn manufacturers, but this did not succeed with us. In all our experiments we have not found any straw so suitable as the rye that produces grain.

In the year 1825, we imported from Leghorn a considerable quantity of unmanufactured straw, which we made into hats; we think it a kind of bearded wheat; the texture of the straw differs from that of rye.

The ground which we have found most suitable, is light coloured sand, but well manured.

To produce fine spindly straw, we require twenty bushels of grain to the acre.

The time when we cut the crop is when in the blossom or milky state.

We tie it at the root ends in small parcels two or three inches in diameter, place it in tubs, put boiling water over it, which remains about half an hour, then spread it on the ground (dry sandy ground is better than grass, being less liable to take mildew), and turn it occasionally; it bleaches in two or three days if the weather is favourable.

The bleaching is attended with so much risk from mildew, that our agent in Orkney thinks it equal to 50 per cent. on the value of the crop. One night, during the bleaching process, of continued rain or fog, will spoil the crop. Any hints, therefore, as to an improved way of bleaching, so as to prevent mildew, will be to the manufacturers of British Leghorn very valuable.

We had last year about five acres of straw, which will produce about 12,000 scores of plat, suppose on the average of three scores to the hat, will be 4000 hats, not more, we

think, than one-hundredth part of the consumption of the united kingdom. These 4000 hats may give to the manufacturer, including his profit, 5000*l.*; for seed and straw seven acres of land would be required, and in manufacturing 500 persons would be constantly employed all the year. We suppose the consumption of Leghorn hats to be not less than 500,000*l.* in the united kingdom, now, were these all made by our own industrious population, 700 acres of poor land would be required, and 50,000 persons would be employed in the manufacture.

In giving premiums for encouraging this art, we would recommend them to be given to the platters and knitters of the straw: the best made hat a premium of thirty shillings; the second, twenty shillings; and the third, fifteen shillings. Cleanness of work being always stated as a high recommendation in awarding premiums. The hats not to undergo any cleansing process after coming from the needle. This manufactory, if introduced, might be productive of much good, by giving our peasantry, who are engaged in it, habits of cleanliness, for the value of the work will always depend very much on its proportionate cleanness. Their houses, clothes, and hands must be kept clean, otherwise they cannot make clean work.

We do not think premiums should be offered to the manufacturers, they will be rewarded by procuring superior work; we think a premium may be offered to the person who raises wheat straw, as spindly as fine wire, and which is also found to bleach to as good a colour as Leghorn hats.

The sum of *five guineas* also was given to Mrs. *Lowrey*, of Exeter, for a hat of double split straw.

No. II.

SILK.

The LARGE SILVER MEDAL *was this session presented to Miss* PETHER, *for Silk grown in England; specimens of which have been placed in the Society's repository.*

THE peculiarity attending the production of this silk (and which particularly induced the Society to distinguish it by their reward) is, that the worms were fed on the common cabbage-lettuce till the last time of changing their skin, when they were put on mulberry-leaves until the time of spinning. A circumstance which, conjoined with the good quality of the silk, appears to deserve the special attention of those who may be contemplating the possibility of growing silk in England on a large scale.

The following letter from Mr. Winkworth, one of the chairmen of the Committee of Manufactures, renders unnecessary any farther observations on the subject.

DEAR SIR, Cheapside, April 24, 1826.

I have examined the samples of English silk entrusted to my care by the Society, and beg to submit the following observations as the result of a careful examination of them. Taking them together, I should say, that in colour, quality, and evenness, they are much superior to any I have ever

before seen of native growth; and with some improvement in the mode of reeling, would be equal to the better sorts of Italian silks. As they are, I can venture to pronounce them quite as good as the average quality of the continental filatures, and much superior to those of the East Indies.

The sample which I have marked No. 1, bears a close resemblance to the silk of Fossombrone, which has the highest character in our market, and is now worth from twenty-one to twenty-two shillings per pound. Those marked Nos. 2, 3, and 4, are similar in quality to the produce of Naples, Bergamo, and Milan, and may be considered as relatively worth nineteen shillings, eighteen shillings, and seventeen shillings. No. 4 would be equal to No. 2, but for the more defective manner in which it is reeled. It is not necessary to give an opinion upon No. 5, for the candidate herself describes it as imperfect; but perhaps it may be as well to observe for her future government, as she may not be aware of the fact, that the greatest objection to it, in the English market, would be the colour, which is too pale. This is a peculiarity which very much enters into the value of raw silk, repeated experiments having, I believe, demonstrated, that those silks which are originally full and bright in colour, retain the dye that is subsequently put upon them much longer than those which are pale.

The defective reeling, to which I have before alluded, is occasioned by the thread not being sufficiently twisted in the process, in consequence of which, it is flat and loose, instead of being round and firm. I request to add, that in these opinions I am confirmed by three gentlemen of great experience as merchants and brokers, one of whom is an

Italian, whose attention, in his native country, was entirely devoted to the culture of the raw material.

I have taken the liberty to send two skeins by a friend to a throwster of considerable eminence in the north, who will, I expect, throw them into organzine and tram.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOMAS WINKWORTH.

PAPERS

IN

MECHANICS.

No. I.

BUILDERS' LEVEL.

The sum of FIVE GUINEAS *was this session presented to Mr.* GEORGE HOOPER, *No.* 1, *Bury-street, Chelsea, for his Builders' Level. The following communication has been received from him, and a model of the instrument has been placed in the Society's repository.*

King's Palace, St. James's Park,
12th January, 1826.

SIR,

BEING for many years past engaged in the same profession I now fill, as foreman of works in various extensive buildings, I have often had reason to regret the want of some more portable instrument than the common builders' level, it being in some measure an incumbrance, particularly so in windy weather, at which time also the correct application of the line and plummet is both tedious and difficult.

I was therefore induced to apply the principle of the spirit level to a pair of boards having parallel edges, which I found more portable, as well as perfectly adapted to obviate the inconvenience of the plummet and line, in consequence of its liability to be blown out of the perpendicular. I then applied the same principle to the same instrument, so as to obtain an operative plum line, which I found equally true, and possessing all the advantages over the common one that it has in regard to the level.

It is now five years since I made this instrument, during which time I have always used it. I carry it generally in my hand during the time I am on the building. It has often been used by the workmen under my care, and by others; but I have never seen, nor have I ever heard of, any other instrument of the like make or description being made use of.

It having lately fallen under the notice of some gentlemen connected with the Society for encouraging Arts, Manufactures, and Commerce, who consider it an object likely to be worthy of the Society's consideration, I am induced to trouble you with this account. The instrument is left at the Society's house for your inspection.

I am, Sir,

&c. &c. &c.

GEORGE HOOPER,
Mason.

A. Aikin, Esq.
Secretary, &c. &c.

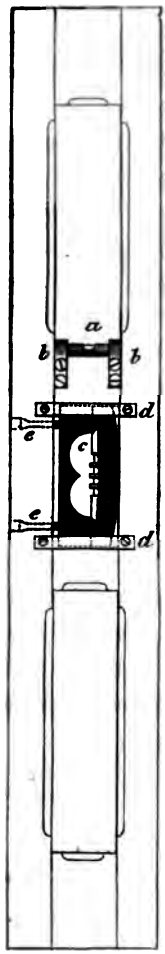


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1 shows the rule in its vertical position, as indicated by a small spirit-level *a*, accurately adjusted and secured in its place by brass straps *b b*; this level is well protected by being imbedded within the thickness of the rule. A second spirit level *c* is adapted for using the rule horizontally; but as this is made to adjust for different slopes, the spirit level is imbedded in a piece of wood, shown separately in figs. 2 and 3, placed within the middle of the rule, and retained there by four brass straps *d d*, two on each side of the rule, those on one side being a little longer than on the other, to allow the screws which secure them to pass each other. Two adjusting screws *e e*, shown by dotted lines, are let into the upper edge of the rule, and so deep that on raising one to depress the other its head may never rise above the surface. Two short screws are let into the wood at *f f*, fig. 2, seen also by dotted lines in fig. 1, merely to give a hard surface for the adjusting screws *e e* to act against; thus the rule may be adjusted from level to any slope within the pro-

vided range. The bottom or sole of the wooden frame in which the level *c* is fixed is made somewhat curvilinear, so as to enable it to yield to the pressure of the adjusting screw.

No. II.

GERMAN BORING-BIT.

The THANKS *of the Society were voted to* BRYAN DONKIN, *Esq., Chairman of the Committee of Mechanics, for two German Boring-bits presented by him to the Society. The instruments have been placed in the Society's repository.*

THE boring-bit, of which the following is a description, was met with by Mr. Donkin in Germany, and it appeared to him, as it did subsequently to the Society, that it might be in some cases a useful addition to the implements already used in this country. The instrument is very simple, enters the wood easily, bores rapidly, and forms a clean hole.

Fig. 1.

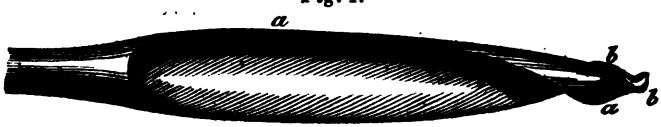


Fig. 2.

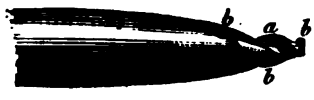


Fig. 3.

Fig. 4.

Fig. 1 a front view of the bowl of the boring-bit; *a a* the cutting edge; *b b* a thread or fin winding round the back, which acts as a screw to draw the bit into the wood. Fig. 2 a back view, showing the thread *b b b*. Fig. 3 a side view, and fig. 4 an end view.

No. III.

TAG SHEARS.

The* Silver Vulcan Medal *was this session presented to Mr. T.* Collett, *Upper Greystoke-place, Fetter-lane, for his Tag Shears; a model of which has been placed in the Society's repository.

A TAG is the bit of thin tin-plate which is fixed to the end of a lace. The usual way of making these is, first to cut the tin plate into pieces of a proper size, by means of shears; secondly, to take each piece separately and bend it to the required form, by hammering it on a fluted mould.

These processes must be got through with great rapidity,

in order to afford the workpeople employed (chiefly women) an adequate remuneration for their time. The sharp edges of the tin are perpetually cutting their fingers, thus delaying the work as well as rendering it painful.

Mr. Collett's shears, by combining the two processes of the manufacture into one, do away with the painful part of it, as well as save time. To many persons the entire manufacture may seem too trivial to justify the interference of the Society; but those who are aware of the immense number of tags annually made and consumed will be of a different opinion.

A side view of the shears, or rather the jaws of them, is represented (Plate II. fig. 7) and the figure to the right hand is a front view of the same at right angles to the former, the corresponding parts in each being marked, not only by the same letters of reference but by dotted horizontal lines drawn from one to the other. The figures above the bracket line are sections of the parts separate.

The upper part of the lower jaw *g* is a groove, the interior longitudinal side of which forms one of the cutting edges of the shears: the piece *h* is screwed to the upper jaw *i*, and is rounded at the bottom, so as to fit the groove in the lower jaw. The piece *k* is screwed to the lower jaw; it is flat at top, and extends parallel to the exterior side of the groove. The slip of tin plate to be cut into a tag enters between the jaws of the shears from the side opposite to that shown in fig. 7, that is, from right to left, as shown in the front view, and is laid upon the piece *k*, projecting as far as the outer edge of this piece. The jaws are then closed, in consequence of which the tag is cut off by means of the sharp edge in each jaw, while at the same time the piece *h*, entering the groove in the

lower jaw, presses down the intervening piece of tin, and thus gives it the form of a hollow semi-cylinder, in which state it is ready to receive the end of the lace. Thus, by merely closing the shears, the tag is not merely cut off but receives the necessary degree of curvature.

The instrument has been in use for some time by a manufacturer, and is found to produce four times as many tags as can be made in a given time by the usual way.

No. IV.

BLIND FOR CIRCULAR-HEADED WINDOWS.

The SILVER VULCAN MEDAL *was this session presented to Mrs.* HENRY GOODE, *of Ryde, in the Isle of Wight, for her Blind for circular-headed Windows; a model of which has been placed in the Society's repository.*

SEMICIRCULAR windows, and rectangular windows with semicircular heads, are common in modern churches and chapels, and in most rooms for public meetings, as well as occurring occasionally in private houses. In the square parts of such windows, blinds of various well known constructions are inserted, in order to exclude, when necessary, the rays of the sun; but the heads are either left without blinds, or are fitted with awkward and imperfect contrivances to effect the desired object. Mrs. Goode's blind answers its purpose very effectually, and is both neater than any other, as well as sufficiently simple to recommend itself to general adoption.

Fig. 1, plate II. is an elevation of the arch of a window; *a a* a metal tube, bent so as to fit the head of the window, and serving as a circular curtain rod: this tube is open all along the upper edge, as shown in the section fig. 6; the ends fit into holes at *b* and *c*, made through the window-bar *d*: at *b* a pulley is fixed, corresponding with the holes and bore of the bent tube *a*; an endless band *e e e*, figs. 1 and 2, enters the tube *a* by the end *c*, goes out at the other end, passes under the pulley *b*, then crosses the window below the bar *d*, passes over the pulley *c*, and the spring catch pulley *f*.

In order to make the blind, a piece of cloth is taken a little wider than the height of the arch, and rather longer than its circumference, and is folded like a fan, as shown in fig. 2; a nail is then passed at the bottom, through all the folds, into the middle of the window bar at *d*, forming a centre to the semicircular tube *a a*; holes are made at the other end in the folds, which allow the blind to slide along the tube, as shown in figs. 4 and 5 (where the tube is removed); the bottom fold is tacked to the window bar near the end *b*, fig. 5; two pieces of tape connect the upper fold with the endless band, by passing through the split tube, as shown in figs. 3 and 4.

The blind is drawn over the window, or withdrawn from it, according as one side or the other of the endless band is pulled, as in the common roller blind.

No. V.

ADJUSTING DOOR-LEVER.

The SILVER VULCAN MEDAL *was this session presented to Mr.* J. ADCOCK, *24, Leman-street, Goodman's-fields, for an adjusting Door-lever; a model of which has been placed in the Society's repository.*

24, Leman-street, Goodman's-fields,
April 18, 1825.

SIR,

I BEG to submit to the Society for the encouragement of Arts, &c. &c. the accompanying model of an adjusting lever for closing a door, the peculiarity of which consists in the variation and disposition of force of which it is capable; first, the force will be more or less by moving the regulating ball upwards or downwards on the projecting arm or lever, so as to counteract any inconvenience arising from sudden changes of the wind, &c.; this ball is fixed in the required situation by means of a pin fastened in the upper part of the hole, and which falls into the holes seen in the lever. Secondly, the disposition of the force will depend on the form of the curve acting immediately on the door.

I am, Sir,
&c. &c. &c.
JOHN ADCOCK.

A. Aikin, Esq.
Secretary, &c. &c.

The particular advantages proposed by the use of this lever are as follow.

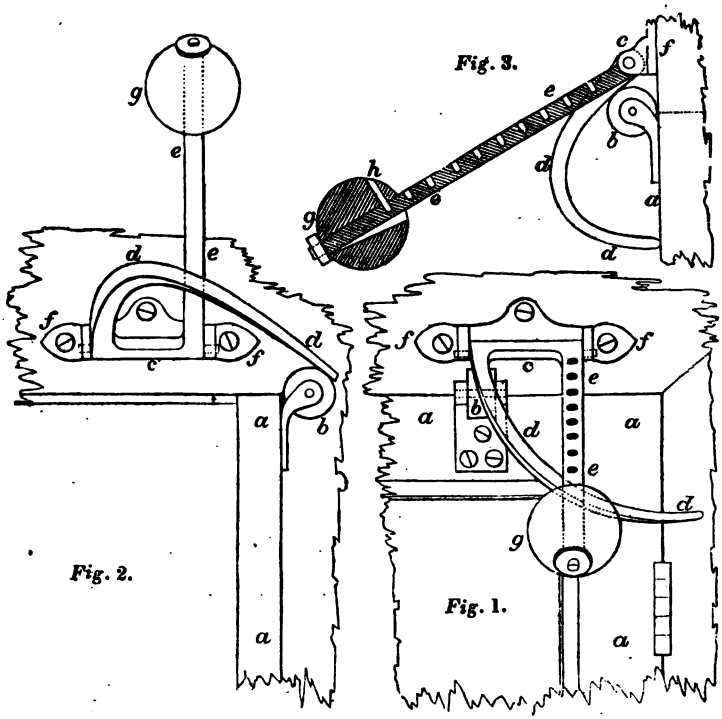
1st. Its force may be varied with facility, according to circumstances, so as partly to prevent the inconveniences produced by changes of the wind, and by particular draughts, which occasion the violent jarring of certain doors, the power of whose weights or springs upon ordinary occasions are not sufficient to shut them.

2nd. It is also capable of any disposition of force which may be deemed eligible, or of being so made as to exert its greatest force upon the door while opened to any particular angle, causing it to shut with an increasing or decreasing velocity, to latch violently, or merely to close.

3rd. As it acts with but little friction, it will perform its operations unheard, or without causing the least unpleasant or disturbing noise, as is frequently experienced in the modes hitherto adopted.

4th. It will be found applicable to any door opening only to a right angle with the post, and may be applied without interfering with the hanging of the door.

5th. Its construction being extremely simple, the expense will be trifling, and as it is not liable to be deranged, it will continue to act as long as its materials will last.



Figs. 1 and 3, *a a a* part of a closed door with one of its hinges, *b* a roller screwed to the top of the door, *c* an axis carrying the curved arm *d d*, and lever *e e*, it moves in the frame *f f*, which is screwed a little above the door; a weight *g* is placed on the lever. On opening the door, the roller *b* travels under the arm *d*, and raises both it and the weight; and as the curvature of the arm *d* is such as to form an inclined plane in every part, the door, on being let go, will close by the leverage of the ball *g* causing the inclined plane to act continually on the roller *b*. Fig. 2 shows the position of the weight when the door is opened

at right angles. Fig. 3 is a side view of the lever, showing it when in the act of holding the door close.

This lever has the desirable quality of holding the door very tight when closed, and thus resisting the wind, and acts gentler the wider the door is opened, so as not to strike with violence against any person following, as will be seen in fig. 3; the distance of the roller *b* from the fulcrum or axis *c* is shortest of all when the door is shut, being about one-eighth of the distance of the weight *g* from the same fulcrum; whereas, when the door is open, the position of the roller is directly under the weight *g*; thus, with an equal slope throughout the arm *b*, the change of force is gradual, that is, equal in equal times; while by varying the slope, any proportion of force, in any part, can with the greatest ease be obtained; and by a hollow in the end of the lever, farthest from the weight, it may be made to hold the door open if required. The ball and lever in fig. 3 is in section, to show the pin *h* within the cavity of the ball, which being dropped into any one of the holes along the top of the lever, detains the weight at the required place. The hole through the weight being wider under the pin than is necessary for the reception of the lever, allows the pin to be raised out of any hole, and transferred to any other at pleasure; the leverage, therefore, may, without difficulty, be adjusted to suit the most windy or the most quiet day. When there is sufficient thickness in the wall above the door, the whole of the apparatus may be concealed, by letting the door turn upon an axis, which rises through the frame, above the door, sufficiently high to allow the descent of the arm *d*, and it must have a short arm on its top, at right angles with the door, to carry the roller *b* at its end, the lever *e* will then be parallel with the

wall, and concealed within it, and as the arm on the axis and the curved arm *d* must be lessened to suit the thickness of the wall, the weight must be increased, or the lever lengthened, to gain sufficient power.

No. VI.

APPARATUS FOR SECURING AND RELEASING A SHIP'S ANCHOR.

The GOLD VULCAN MEDAL *was this session presented to Mr. W.* SPENCER, *Ordnance-place, Chatham, for his Apparatus for securing and letting go Ships' Anchors; a model of which has been placed in the Society's repository.*

11, Ordnance-place, Chatham,
October 5, 1825.

SIR,

HAVE to request that you will be pleased to submit, for the consideration of the Society of Arts, the accompanying model (which I also request the Society to accept) of part of the bow of a 74-gun ship, fitted with my plan for letting go ships' anchors.

The said plan was projected in 1819, and first fitted in the Forte, at the express desire of Captain Sir Thomas Cochrane, in 1820; and subsequently in numberless other ships, by request of the respective captains.

The Navy Board have awarded me the sum of 150*l.*, and ordered its general adoption in his majesty's navy, as

will be seen by the subjoined copy of a letter from their secretary.

As there are, doubtless, many naval gentlemen amongst the members of the Society, they will perceive the advantages which my plan possesses over the old, tardy, and often extremely dangerous mode of letting go ships' anchors, particularly if the ship is running on a lee-shore; as well as the considerable saving in the wear and tear of the stopper and shank-painter ropes.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WM. SPENCER.

(Copy.)

SIR, Navy Office, Aug. 8, 1825.

The commissioners of the navy having, in consequence of your letter of the 28th ultimo, again taken into consideration the reports which had been received previously to the 11th ultimo, and likewise others subsequently received, on the merits of the stopper and shank-painter of your invention, I have their commands to acquaint you, that they have now determined on the general adoption thereof; and have also come to a resolution to allow you 100*l.*, in addition to the 50*l.* already awarded; and in authorizing you to draw upon the Board for that sum, I am to apprize you that they have much satisfaction in thus marking their testimony of the benefit the service will receive from your zeal and attention to its interests.

I am, Sir,

Mr. W. Spencer, &c. &c. &c.

11, *Ordnance-place, Chatham.* G. SMITH.

Reference to the figures.—Plate IV.

Fig. 1, a bird's eye or horizontal view of the anchor, as secured to the side of the ship; *a* the shank, *b b* the flukes, of which one rests on the channel of the ship, and *c* the stock of the anchor. The fast end *d* of the shank painter is a rope secured to the timber head *e*, and terminating in a chain *f*, which passes round the shank of the anchor, and has its last link placed over the trip bolt of the machine *g*. The stock is fastened by three or four turns of rope *i*, to a ring *j* in the top side. Through the head of the anchor *k* passes the ring *l*, fig. 2, which is supported by a rope called the stopper *m m m*, having one end made fast to the timber-head *n*, thence passing over the chock *o* fixed to the cat-head *p p*, then doubling down through the ring of the anchor, and having the link in which the running end terminates, supported by the trip-bolt of the machine *q*.

Fig. 3 is a side view of the machine *g*, fig. 1; *f* part of the chain of the shank-painter, the last link of which is laid over the trip-bolt *r*; this bolt falls forward, making nearly a semicircular turn on the axis *s*, as shown by the dotted line, when not supported by the bar or lever *t*. This bar is in figure like the half of a pair of curved forceps, its hook or loop *u* embraces the trip-bolt *r*, it moves on the fulcrum *v*, and is perforated at the end to receive a wooden bar *w*, which lengthens that arm of the lever when required; *y* is the iron frame which holds both the trip-bolt and the lever; it is let into the side of the ship, as shown by the dotted lines, and is secured by the bolts and staples *x x*; a pin *z* passes through a hole in the frame, and, till it has been withdrawn, prevents all motion of the lever in the direction required for loosing the trip-bolt.

Fig. 4 is an elevation of part of the ship's side from within, in which *d* and *e* represent the same objects as they do in fig. 1, and *a* is the front of the apparatus *g*.

Fig. 5 is *a* in fig. 4 on an enlarged scale; *c c* is an angular slit in the ship's side, to allow *b*, the hollow end of the lever *t*, fig. 3, to move sufficiently to release the trip-bolt *r*, fig. 3; *w w* is the wooden bar *w*, fig. 3, suspended by two rings, which is its proper place when not actually in use; *z* is the pin marked by the same letter in fig. 3.

Figs. 7, 8, 9, are a lateral elevation, a front elevation, and a bird's eye view of the apparatus *q*, figs. 1 and 2, by which the stopper-rope *m m m*, fig. 2, is held fast, or cast off. It consists essentially of the same parts as that for the shank-painter already described; *t* the long arm of the lever bar, having a hole at the end, through which a rope is passed when the stopper is to be cast off; *v* the centre or fulcrum on which the bar moves; *u* the hooked short arm of the lever, embracing and securing the trip-bolt *r*, on which is hung the chain *f* by which the stopper is terminated; *s*, fig. 8, the pin or axis on which the trip-bolt turns. In order to cast off the stopper, reeve a rope through the hole at the end of the lever bar *t*, draw out the pin *z*, and hawl on the rope; the bar will turn a few degrees on the pin *v*, the hooked end *u* will be withdrawn from the trip-bolt *r*, and this being no longer supported, will fall forwards, and allow the chain *f* to slip off.

For the usual mode of securing and releasing the anchor of large ships, the reader is referred to volume xlii. of the Society's Transactions, page 99, in which is a description of an apparatus by Captain G. G. Burton, for the same purpose as Mr. Spencer's, which was rewarded by the Society in the session 1823-4. The only document sent at

that time by Captain Burton, from which the date of his invention can be inferred, is Captain Warren's letter, page 103, from which it may be concluded that Captain Burton's plan was tried on board the Seringapatam, some time previous to April, 1821. It, however, appears, from subsequent inquiry, that a Navy Board order, dated July 29, 1820, was addressed to the officers of Chatham-yard, directing them to fit Captain Burton's cat-head stopper on board the Forte.

No. VII.

SHOT CARTRIDGE.

The sum of FIFTEEN GUINEAS *was this session presented to Mr.* JOSHUA JENOUR, *Jun.* 31, *William-street, Hampstead-road, for his Shot Cartridge. The following communication has been received from the candidate, and the punch for making the cartridge cases, as well as specimens of the cartridges themselves, have been placed in the Society's repository.*

31, William-street, Hampstead-road,
November 2, 1825.

SIR,

GIVE me leave to offer to the notice of the Society of Arts an invention of mine, for the purpose of shooting at much greater distances than can be accomplished in the present way of charging guns, consisting in a sort of shot-cartridge, constructed upon a new principle, totally different from any thing of the kind hitherto used, and

equally, I presume, applicable to military as to sporting purposes. Mr. Joseph Egg, gun-maker, No. 1, Piccadilly, has witnessed shots made at seventy, eighty, and a hundred yards distance, equal in strength and closeness to shots generally made at forty yards with a fowling-piece. I shall be happy to make experiments before any members of the Society, and to communicate the invention, with specimens, &c.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOSHUA JENOUR, Jun.

The unwinding of a cord or twine, a chain or wire, from a spiral groove infolding the charge of shot, constitutes the chief principle, by means of which they are thrown from the gun in a mass, and dispersed at various distances. Two or more pieces of metal are so constructed, as when bound together by the twine, &c., to form a cylindrical case, inclosing the charge of shot, corresponding to the size of the gun, and having a regular spiral groove from end to end, similar to a common screw. One end of the twine is made fast, and the other is left free, to be unwound by the resistance of the air acting upon it during the passage of the cartridge. The unwinding of the twine being completed, the centrifugal force occasioned thereby opens the case and liberates the contents. One of the subordinate points of construction is that of filling the interstices of the charge with fine sand, or other matter, either mixed or not with tallow, in order to prevent the fired powder from penetrating into and deranging the

construction of the cartridge; and also for the purpose of preserving the spherical form of the shot, whereby the penetrating force is increased.

The experiments which I have individually made, in a very imperfect manner, under every disadvantage, may be considered as merely amounting to a discovery of the important principle here described. Various trials upon an extensive scale are evidently required, in order to fix the minute particulars of construction for cartridges, to break uniformly at various given distances; as the quality and substance of the metal, the size of the grooves, and the number of turns, the quality and size of the binding-cord, the exact adjustment of its loose end, so that it be uniformly acted upon by the air in its passage from the gun, the general and nice uniformity of sizes, weights, &c., of cartridges for each particular distance; with other minute practical points requisite to attain a general uniformity of construction, and a consequent certainty of effect.

Numerous, accurate, and systematic experiments would, I have no doubt, ultimately lead to the production of cartridges highly complete, to shoot close and strong with a fowling-piece at any required distance, to the extent of several hundred yards.

The following data are collected from the experiments which I have made. The distance to which the shot are conveyed in a body is to be regulated by the number of turns or length of the binding; also by the specific gravity, the texture and the size of it, and by the charge of powder.

The shorter the binding the less will be the distance to which the shot are conveyed in a body, and *vice versa*. The case should be of the least possible weight, to possess

sufficient strength to resist any compression by the action of the discharge, and should retain the whole of its contents until the last turn of the binding is unwound.

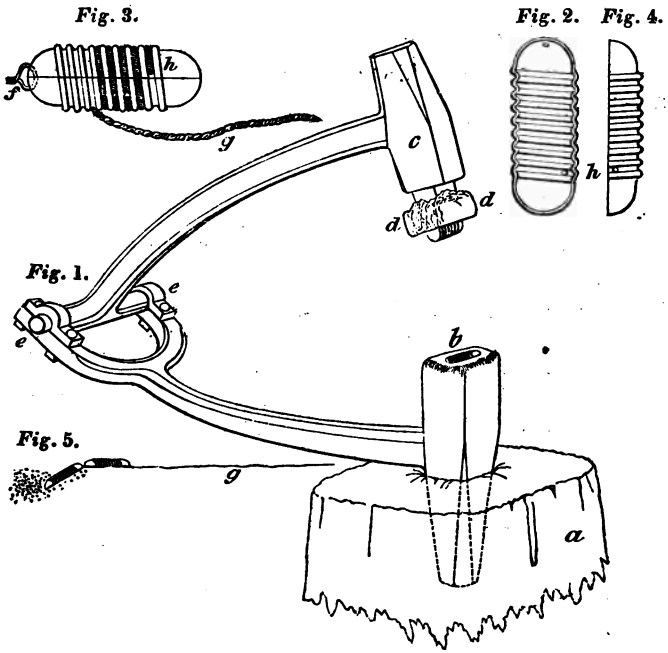


Fig. 1 the mould fixed in the block *a*; *b* the hollow which gives shape to half a cartridge; *c* the hammer or punch, the nose of which is covered with lead *d d* cast in the mould, and on it at the same time; *e e* the joint. Fig. 2 an inside view of a half cartridge, made of copper sheet (half the real size); it serves also to represent the hollow of the mould, which is worked like a screw, so that when two of these shells are tied together with string or copper wire, through two holes at *f*, fig. 3, they form one

continuous spiral, along which the string *g* is wound; *h* a hole, through which one end of the string is secured by a knot on the inside: the end of this string *g* is left loose as a tail, by which the cartridge is caused to revolve in its flight until the string is quite unwound; it then opens and lets out the shot like fig. 5. Fig. 4 is a side view of half a cartridge.

On the 12th December last some experiments were tried at Bayswater, by direction of the committee.

The gun employed on this occasion was a duck-gun belonging to Mr. Beckwith; it was fired from a rest, and the mark was at the distance of one hundred yards. The mark consisted of five open sheets of common brown paper, three being placed in one line, and the other two forming a second line immediately below, and touching the upper one.

Experiment 1st. Powder, 2½ drachms; shot, 2½ ounces, of No. 6; weight of charge, including the cartridge case, 3 ounces: 102 shots put in, some in every sheet.

2d. Powder, 3 drachms; shot as before: 199 shots put into the middle and right hand sheet of the upper row.

3d. Charge as before, except that the shot was No. 2, and the cartridge, which in the former trials had been bound with thin twine, was in this bound with whipcord: 14 shots put into the middle sheet of the upper row.

4th. Charge as before: 19 shots put into the right hand sheet of the upper row.

The following experiments were made with slugs:—

5th. Powder, 3 drachms; slugs 33, weighing 2½ ounces: 14 were put into a target four feet square.

6th. Charge as before: 10 slugs put in.

7th, 8th, 9th, and 10th. Charge as before, but omitting the cartridge: 2, 3, 5, and 12 shots were respectively put into the target.

In the above experiments most of the slugs, and even some of the shot, pierced through twenty-five folds of brown paper.

The Society are of opinion that Mr. Jenour's cartridge possesses the merits of novelty, ingenuity, and probable utility, especially for wild-fowl shooting. They are aware that many experiments remain to be tried, in order to ascertain the precision of which the invention is capable, and will be glad to receive farther information on this subject.

No. VIII.

VALVE AND STAND-PIPE FOR WATER-MAINS.

The sum of FIVE GUINEAS *was this session presented to Mr.* DAVID MAGSON, *26, Harp-alley, Fleet-street, for a Valve and Stand-pipe for Water Mains; models of which have been placed in the Society's repository.*

GENTLEMEN,

I VERY respectfully beg to call your attention to an invention which I conceive must eventually prove of great public utility, but more especially to the interests of the

various water companies, whenever the same may become generally used.

The improvement to which I allude is a *water-guard*, simple in its construction, effective in its object, and acting on a valve, a model of which I have sent for the inspection of the committee.

The invention will prove a great saving in the fitting up of cisterns, and particularly through the abolition of the expensive brass cocks, copper balls, &c. which of themselves do not, nor ever did, afford sufficient security to the water companies, much of the water being at present wasted through the carelessness or ignorance of housekeepers and their servants, by the cisterns being allowed to overflow after they have been filled.

The peculiar merits of my invention appear to be the following.

1st. It acts under a column of water of upwards of seventy feet with the greatest ease, and closes without the least noise.

2d. It will supply cisterns to the fullest extent during the winter, though the draw off cock of the same may be quite frozen, and will inject a supply in half the time of the present ball-cock, as has been ascertained by a trial of upwards of two years.

3d. The price of these articles will be about 25 per cent. less than ball-cocks, and being of cast-iron, consequently are not worth stealing.

I also beg leave to offer to the notice of the Society, an improved stand-pipe, which has been tried, during the last winter, at the West Middlesex Water Works, Berners-street.

It has the advantage of giving an abundant supply in less

time than any other; it cannot be left open by neglect, as it shuts off by its own pressure; it also remains longer unfrozen than the common stand-pipe, and as the water cannot run to waste out of it, the accumulation of ice in the street round about, which is a serious inconvenience in the use of the common stand-pipe, is hereby prevented.

CERTIFICATE.

West Middlesex Water Works' Office,
Berners-street, April 28, 1826.

SIR,

We have had one of Mr. Magson's ball-valves at work for some time past, and it appears to answer the purpose very well, and I have no doubt but it will be found of very considerable advantage to water works in general, and it is an invention deserving the attention of the Society.

I am, Sir,
&c. &c. &c.
W. TURNER, *Clerk.*

A. Aikin, Esq.
Secretary, &c. &c.

In the 38th volume of the Society's Transactions, is a description of Mr. Bullock's ball-valve, intended for the purpose of superseding the common ball-cock. The general construction of Mr. Magson's valve is the same as Mr. Bullock's, consisting of a lever, having a float at one end, and bearing upward by the other against the pin or tail of a valve fixed in the delivering pipe. When the cistern is full, the lever is brought, by the action of the float,

into a horizontal position, and then its short arm being lower than the end of the valve-pin, exerts no action on it; the pressure of water in the delivering-pipe, therefore, keeps the valve shut, and prevents the outflow of the water. In proportion as the water in the cistern is drawn off, its level subsides, and with it the float attached to the long end of the lever; the short arm rises in proportion, takes its bearing on the end of the valve-pin, and as soon as its pressure becomes superior to the counter-pressure of the water above the valve, it raises this latter, and the water flows into the cistern, till by its rise the pressure of the lever on the valve-pin becomes inferior to that on the valve itself. The valve then descends, and the supply of water ceases.

The superiority of Mr. Magson's valve consists in the fulcrum of the lever being placed directly below the valve, and in the curved form of the short arm, whereby the power of the float to raise the valve is greatly increased.

Figs. 1 and 2 are a side and front view of the valve-box and lever, and fig. 3 is a section of the same: *a* the box; *b* the mouth which enters the end of the main or supply pipe, and through which the water flows into the box, as shown by the arrow; *c* the lower mouth, through which the water flows out of the box into the cistern; *k*, fig. 3, the valve, the tail of which passes through the guide cylinder *l*, and terminates in the knob *m*, figs. 2 and 3; *j* a round flat float, fixed to the end of the long arm of the lever, either simply by a screw, or better by a hinge-screw, as shown fig. 4; *q* the axis or fulcrum, supported in the

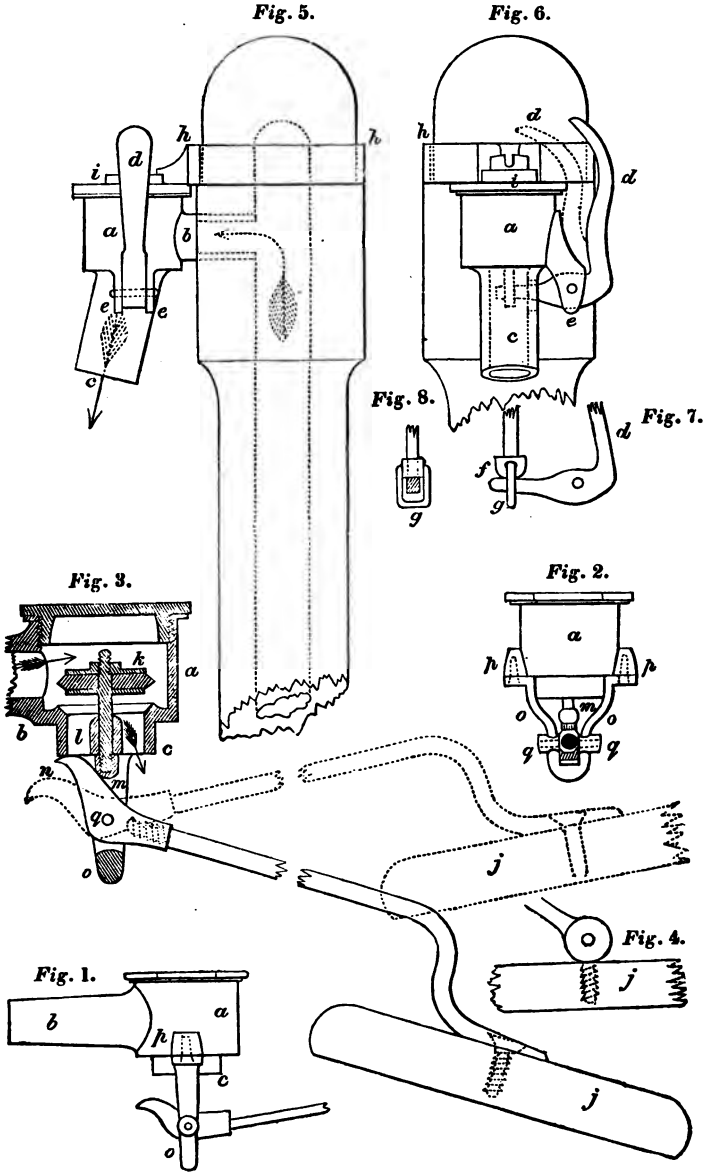


Fig. 5.
Fig. 6.
Fig. 8.
Fig. 7.
Fig. 3.
Fig. 2.
Fig. 4.
Fig. 1.

two arms or braces *o o*, which are themselves fastened to the valve-box by means of the screws *p p*; *n* the short end of the lever, which, by bearing on the knob of the valve-tail, raises the valve, and allows the water to flow out at *c*, as shown by the arrow.

The common stand-pipe for the supply of water from the street-mains, when the smaller pipes, that convey the water into the houses, are obstructed by ice, is simply an upright wooden pipe, the open end of which is driven into the main: at the closed end is a lateral hole, fitted with a faucet and spigot for drawing off the water. The spigot is often left out from carelessness or wantonness, whereby a waste of water is incurred, and the street about these stand-pipes soon becomes obstructed more or less by ice.

Figs. 5 and 6 are a side and front view of Mr. Magson's stand-pipe: *b*, fig. 5, is the lateral hole through which the water passes out of the pipe into the box *a*, and is discharged through the spout *c*. In the box is fixed a valve, similar to that already described, except that the tail terminates in a stirrup *g*, figs. 7 and 8, into which the short arm of the lever is received; the dotted line *d*, fig. 6, shows the ordinary position of the lever when the valve is pressed down by the weight of the superincumbent water; when the lever is drawn outwards to the position indicated by the other *d*, fig. 6, the short arm presses upwards, raises the valve, and allows the water to flow out; on letting go the lever, the valve immediately shuts, and there is no loss of water; *h h* is an iron collar that surrounds the head of the pipe, having a projecting piece, to which the valve-box is secured, by means of the screw *i*; *e e* are the two braces which support the fulcrum of the lever.

No. IX.

STAGE COACH.

The sum of THIRTY GUINEAS *was this session presented to Mr.* JAMES SKINNER, 81, *New Park-street, Southwark-bridge, for his proposed Stage-coach; a model of which has been placed in the Society's repository.*

THE model produced before the committee by Mr. Skinner was considered by the coach-builders and axle-makers present to combine, in a more ingenious and practical manner, the various improvements which for several years past have been proposed, and in part adopted, in the construction of stage-coaches. So large a proportion of the travelling in this country is performed in these vehicles, that all proposals for improving them, by diminishing the labour upon the horses, and the liability of the passengers to accidents from the carriage overturning or breaking down, have been received with great attention by the Society, and rewarded, if they offered even a probability of success. The lowering the centre of gravity, by removing the heavy luggage and outside passengers from the roof of the carriage, the convenient accommodation of these latter, the adoption of high fore-wheels to ease the draft, and several minor conveniences, will be found to have been duly attended to, and to be combined in the model, of which the following is a description.

Reference to the Drawing of Mr. Skinner's Safe Coach. Plate III.

Fig. 1 a bird's-eye view; fig. 2 a perspective view; and fig. 3 a side elevation, with the near wheels off. The front wheels are five feet nine inches, and the hind wheels six feet three inches, in diameter. The inside and outside passengers are seated on the same level, the floor being as near to the axle-trees as the play of the springs will admit. *a* the door through which the hind passengers get up; *b b* their seats; *c* a seat for the guard, attached to the door *a*; *d d* iron bars, at top and bottom of the door, projecting enough to be securely held by the iron turn-buckles *e e*; *f f* the front seats, the steps *g h* and *i* serve for them and the coachman to get up by; the passengers step on the boards *j j*, and over the side-rails *k k*; the steps *l m n* and *o*, serve for ascending into the hinder part of the coach; *p p* boards over the hind wheels; these, as well as similar ones *j j*, over the front wheels, have iron rails to hold small luggage: the dotted lines in fig. 1 show how the floor is narrowed, to allow of locking the front wheels; *q* the hind boot; *r r* the front boot; *s* boxes opening in the floor of the coach; *t* and *v* pockets in the guard's seat; *u* a roll of leather, to cover the front passengers; it has a slip of iron along its front, which catches on the hooks *w w*; it is wound up and held tight by a ratchet-wheel and hatch *x*; the end of the axis is squared to put on a winder: *y* the locking pin, which plays through the axle-tree: *z* the locking plate under the floor and above the springs; there are five springs in front and five at the back, two across each axle-tree, and four across the coach, answering to them, and two more, one over each axletree, and rubbing on them.

No. X.

TRAP FOR VERMIN.

The sum of FIVE GUINEAS *was this session given to Mr.* JAMES SKINNER, 81, *New Park-street, Southwark-bridge, for his Trap for Vermin; a model of which has been placed in the Society's repository.*

TRAPS on the principle of the pitfall are more likely to be successful in taking all kinds of quadrupeds than box-traps and snap-traps, as less likely to excite suspicion in the animals for the capture of which they are intended. If to a trap of this description be superadded the advantages of setting itself after the capture of each animal, and of receiving and quietly destroying any given number that can be supposed likely to enter it in the course of a night, or any other interval, every desirable quality of a trap seems to be attained.

Mr. Skinner's trap consists of a kind of stall, adapted to the size of the animal intended to be taken, open at top and at one end. At the opposite end is a hook, on which the bait is placed. The hook is suspended loose from the top, and has a crook or angle at bottom, which when the hook hangs perpendicular lies immediately under a roller.

The frame which carries the roller is fastened to the floor of the trap, and the floor itself is capable of turning sideways on a hinge, furnished with a weighted lever projecting

on the other side, and a little more than a counterbalance to the floor. While the hook remains perpendicular, its angle, by its position under the roller, supports the floor when loaded with the weight of the animal intended to be taken; but when such animal by pulling at the bait has drawn it somewhat oblique, the angle will have slipped from under the roller, and the floor being now unsupported will incline on the side opposite to the hinge; the animal being suddenly thrown into an unusual position, and one unfavourable for sudden effort, and being prevented from clinging to the floor by the impossibility of forcing its claws into the sheet iron with which the floor is covered, will slide down into the box below, and the counterbalance will immediately cause the floor again to resume its former position. If the box is left empty the animal will be taken alive; but if it is intended to take more than one in succession the box should be filled with water, that the animal first taken may be dispatched before the arrival of the next.

Fig. 1 a side view in section; fig. 2 an end view, the lower part in section; fig. 3 a bird's-eye view, the bait, hooks, and bar, from which they hang, being removed; *a a* and *b b* the two sides of the trap; *c c* two end bars, which with the top bar *d*, and middle bar *e*, form a frame by which the two sides are united; *f f* two bait-hooks, hanging from the cross-bar *d*; *g g* two rollers on the bridges or staples *h h*; *i i* and *j j* the floors of the trap, they are hung on hinges *k k* and *k k*, with balance weights *l* and *m*, (seen by dotted lines in fig. 1), just heavy enough to bring up the floors, and make the rollers *g g*, which are fixed to

them, catch on the bait-hooks *f f*; the flap *j* is shown as held up by its roller *g*, in the angle or crook of the bait-hook; *n n* the two baits; the flap *i i* is shown in the act of inclining downwards, the animal having pulled the bait-hook from the roller *g*, and having slipped into the receptacle *o o*, which is partly filled with water; the balance-weight *l* then brings it up again, and re-sets it; *p p* parts of inclined planes for the animals to ascend by, when the situation does not allow the cistern to be sunk, so as to bring the floor on a level with the ground. The trap merely rests on the receptacle *o*, by the ledges *q q*; *r r* bent pieces of tin, which narrow the space on the bar *e*, and oblige the bait-hook to fall within the range of the roller *g*, and leave nothing for the claws of the animal to lay hold of at the moment of falling.

No. XI.

IMPROVED DEAD EYES.

The SILVER VULCAN MEDAL *was this session presented to Mr.* EDWARD CAREY, *of Bristol, for his improved Dead Eyes for Shipping. The following communication has been received from him, and a model of his invention has been placed in the Society's repository.*

SIR, Bristol, April 19, 1825.

OBSERVING the very awkward manner in which they set up our men-of-war's lower and topmast shrouds, which

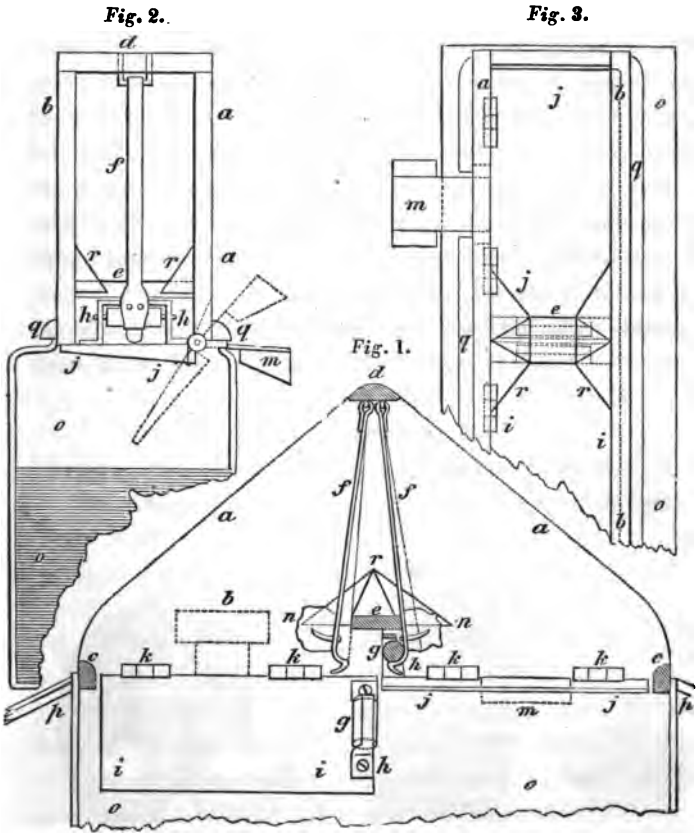


Fig. 2.
Fig. 3.
Fig. 1.

strains the lanyards to pieces, often breaking them, and rendering the same lanyards almost useless for a second time; and with what difficulty the lanyards render over the rough grain of the elm-wood, of which the dead eyes are usually made, in consequence of which the shroud is with great difficulty set up taught, I have made a simple improvement, which I beg leave to lay before the Society for their approval. Half-sheaves of lignum vitæ fixed in the dead-eye will cause the lanyard to render with greater facility than it does at present, and the shroud will be set up in half the time. I have sent a loose half-sheave, to show the manner they are fixed in, by which it will be perceived they cannot come out, for the more pressure there is on them, the faster they are.

I am, Sir,

&c. &c. &c.

EDWARD CAREY,

Surveyor of Shipping.

A. Aikin, Esq.

Secretary, &c. &c.

Fig. 1.

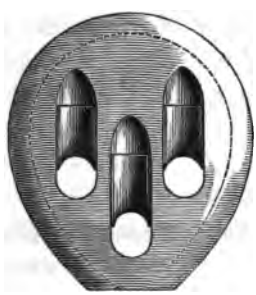


Fig. 2.

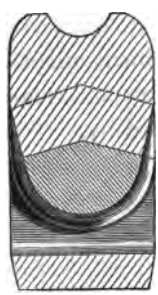


Fig. 3.

Fig. 1 the dead eyes; fig. 2 a section; and fig. 3 one of the sheaves, formed of pieces of nicely turned lignum vitæ, which is let into each hole, as shown in the section.

No. XII.

BANKING FOR CHRONOMETERS.

The SILVER VULCAN MEDAL *and* TEN GUINEAS *were this session presented to Mr.* JOHN THOMAS TOWSON, *of Devonport, for his Banking for Chronometers. The following communication has been received from him, and a model of his invention is placed in the Society's repository.*

SIR, Devonport, April 18, 1826.

I TAKE the liberty to direct your attention to a plan I have invented for banking the chronometer. The nature and advantages of which I have attempted to describe by an explanatory paper, connected with a chronometer, in which the apparatus is adopted, and a model of the bankings. If any other information be required, it will with pleasure be afforded by,

Sir,

Your's, &c.

JOHN THOS. TOWSON.

A. Aikin, Esq.
Secretary, &c. &c.

P.S. As my residence (Devonport) is two hundred and twenty miles from London, and as I have a desire to be in town when the subject is discussed, to answer any inquiries the committee should think fit to make, I should

feel myself under the greatest obligation, if it be allowed to come under their consideration as soon as is convenient.

The balances of all moveable time-keepers, the chronometer excepted, are prevented from vibrating beyond the proper arc by what is called bankings. The inferior escapements are very easily banked; a pin fixed in the balance, coming in contact with one or two studs, is sufficient for that purpose. But, as this plan can only be adopted when the vibration is less than 360°, it cannot be applied to the chronometer, the vibration of which generally amounts to 400° or 500°. The duplex escapement has a banking, although its balance sometimes vibrates more than a revolution. This is effected by a piece of steel, having an arm which strikes against a stud, and is so contrived as to shift 180° on the arbor, and consequently does not check the balance when the arm strikes the stud; but the arbor revolves within the shifting piece until the vibration is completed. This plan introduces a very injurious friction into the machine; it is true the shifting piece is light, but the surfaces in contact are very considerable; and composed of the same metal. This friction influences the balance when its momentum is at its minimum, and is very irregular in its operation; the position of the watch, or its motion, and in fact every contingency, serves to vary the degree of friction produced by the banking. Besides these evils, the shifting piece being out of poise, and altering its situation on the arbor, renders it impossible to adjust the balance for position. These evils are not much noticed in the duplex watch, in which the irregularities arising from the variation in position and temperature are considered

unimportant; but as these and other evils are counteracted in the chronometer, if similar bankings were introduced into that machine, the errors arising from them would be comparatively very great, and on that account it is not usual to bank the chronometer.

The chronometer not having bankings renders it liable to serious injuries; any circular motion has a tendency to overturn the escapement, and this liability increases in proportion as the centre of motion approaches the centre of the balance. Violent concussions, and pressing the winder the wrong way, have been known to produce the same effect. When the balance overturns, three teeth of the escape-wheel are discharged at one vibration, and the chronometer gains 120″ per minute whilst the balance continues to overturn, which it often does, until some means be adopted to check its motion; and when the balance resumes its usual arc, the chronometer generally loses considerably on its rate. If the balance be suffered to overturn, it obtains a new position from the new form acquired by the balance-spring, and consequently new adjustments are required.

These evils have given rise to various plans for banking the chronometer; but as these methods were imperfect they are laid aside. The first plan adopted to answer this purpose was invented by the late Mr. Brookbanks; it was effected by a bolt thrown out by the balance-spring when unwinding, so as to stop a pin fixed in the balance when the balance vibrated to the right; but this banking suffered the balance to overturn towards the left, and when in action caused an injurious friction of the balance-spring. There are various modifications of this plan; but as these alterations produce no advantage, it would be useless to describe them. The next method was invented by Mr. Arnold; and Mr. Hardy

has invented a modification of the same plan. These bankings are fixed to and supported by the balance-spring. Mr. Arnold found the plan injurious, as it rendered the coils liable to touch, and on that account laid it aside many years since. These, as well as the other plan, only banked on one side, and on that account are very imperfect.

The plan to which I take the liberty to direct your attention banks the balance on both sides, operates without friction, does not encumber the balance-spring, nor render it liable to jar; and it will bear the severest trial, some part of the machine giving way before it will cease to produce the desired effect. It is very simple in its construction, and may be made by an ordinary workman. The plan I adopt is to form two planes in front of the stud to which the balance-spring is fixed, and taper the stud to a strong spring. On my balance-arbor I fix a piece of steel, the shape of a fan, having an upright ridge about 80° round the balance; the piece is first turned in a circle, and afterwards shaped with a file; when the balance is at rest, the centre of the ridge stands between the planes on the stud; but if the balance moves 270° either way, one or the other of the planes checks the ridge, and prevents further vibration. The spring-stud is moved by the unequal action of the balance-spring. This is evident from the circumstance, that the spring moves contrary to the balance; if the motion were not produced by accumulating an unequal action of the spring, it would of course move with the balance. Independent, then, of the banking, the effect produced in rendering the spring more equal in its action must be beneficial. Besides this advantage, it decreases pivot friction, for if one end of a spring has a tendency to move right or left, the other end must have a contrary inclination of equal

force. Since, then, the one end of a balance-spring has a tendency to move with a force sufficient to bend the strong spring-stud, the other end would, with the same power, force the pivot to the opposite side of the hole, if an ordinary stud were used. But as the spring-stud accommodates the balance-spring, in so doing it must relieve the pivots from a degree of friction equal to the force that the balance-spring exerts on the spring-stud in bending it. To prove whether this theory were correct, when the chronometer was in the rough, I made a piece of steel to pass over the spring, so as to render it stationary, and I found the vibration sensibly less when the stud was fixed, than it was when the spring was allowed to act, which I considered to be the effect of the friction alluded to. The fan piece can be so placed as to poise the balance, by compensating for the piece cut out of the roller.

The evils arising from the balance overturning have almost done away with the use of chronometers for pocket purposes; the motion of the body in both walking and riding, the act of taking it out of the pocket, inattention in winding, or any unsteady motion, is sufficient to render the machine useless. On this account the preference has of late years been given to the detached lever, although an inferior escapement. Compensation balances have been added, and the adjustments attended to. I have finished such watches, and am convinced chronometers might be made with bankings in less time. Chronometers are dearer, because as they are useless for the pocket, they are now manufactured for nautical purposes only, and the trade is consequently confined. Although bankings are by far more requisite in a pocket-watch than in a marine timekeeper, it is of great advantage even in nautical pur-

purposes. Carelessness of those who wind the machine has often caused serious errors. Concussion from firing guns is so likely to produce these injuries, that it has lately been thought requisite to send the chronometer in a boat to some distance before the guns are practised. If the chronometer be not held perfectly steady in the hand whilst winding, the balance overturns. This rule cannot be attended to during a storm. The concussion of guns, and the motion of the ship at that period, increase its liability to overturn. And what adds to the importance of this circumstance is, that it is after such an event that an error is likely to be serious. During fair weather, the dead reckoning would detect a very considerable error; but in a storm the cause cannot be ascertained; the log is of no use, and consequently a rate is taken as soon as an opportunity occurs, and the result confided in, if the performance of the machine be generally good. A confidence in a false reckoning subjects the mariner to considerable inconvenience, and exposes him to imminent dangers.

Reference to the Engraving of Mr. Towson's Banking for a Chronometer.—Plate V.

Fig. 1. *a* the balance-spring stud, rendered elastic by tapering, it is here attached to the underside of the cock, shown only by dotted lines *b b*, but may be on a separate foot, according to the will of the workman; *c d* a plane with a square notch through it, placed on the end of the spring-stud, seen better in fig. 2, which is a front view; *e e* a piece of steel, part of which is a segment, the circumference of which is turned up at right angles. When the

balance is at rest, as in figs. 1 and 2, the centre of the upright ridge remains free in the notch *c d*, the elastic stud *a* being a tangent to it; but when the balance vibrates 330° to the right, the balance-spring brings the elastic stud so much nearer to the centre, that the side *d* stops the ridge of the fan, as shown in fig. 3; in like manner, the side *c* stops the balance from vibrating more than 330° to the left, as shown in fig. 4, so that the total vibration is limited to 660°, and by increasing or decreasing the width of the fan *e*, the vibration may be limited to any arc between one and two circles.

Fig. 5 is a side view, the balance and balance-spring, all but its two ends, being in section, to show the ridge of the fan *e*; in the notch of the plane *c d* the balance-spring is pinned to the stud, close by the end *d*.

No. XIII.

DRAG FOR DROWNED BODIES.

The SILVER VULCAN MEDAL *and* FIVE GUINEAS *were presented this session to Mr.* S. WILLIAMS, *2, Stone-stairs, Ratcliffe, for a Drag for Drowned Bodies. The following communication has been received from the candidate, and a model of the apparatus has been placed in the Society's repository.*

SIR, 2, Stone-stairs, Ratcliffe.

I HAVE sent you a drag for the purpose of raising persons that have sunk under water; the drag, you will see, must

consist of thirty or forty feet of small chain or rope, capable of bearing at least one hundred weight, with hooks of four prongs, with the extremity of the prongs turned up about half an inch, and split; those hooks are to be made fast to short chains or ropes and hung on the main rope, at about two or three feet apart near the middle, and further distant towards the ends. By this method of making drags they will come very cheap, the whole cost not exceeding ten shillings; and they are, in many respects, much better than those in common use, as they will take a much greater space each haul, thereby saving time, and may be dropped under barges, timber, &c., which is very difficult with other drags. In canals also they will be found very useful, and should be made long enough to take the whole breadth of the canal, and the hooks should be placed a little closer together. A person on each side the canal could drag any space required in a short time. One on a larger scale would probably be useful to those employed in the preventive service, for raising such articles as have been sunk by smugglers, instead of the creeper-drag now in use for that purpose. I have made experiments with a bag, about two feet long, and one wide, filled with rubbish, which I seldom missed the first haul, especially under barges. The drag is intended to be used by two persons, one at each end; but if two persons are not at hand, one end of the drag must be made fast to any thing that is convenient, and the person taking as great a sweep round with the other end as the nature of the place will admit.

I am, Sir,

&c. &c. &c.

SAM. WILLIAMS.

A. Aikin, Esq.
Secretary, &c. &c.

Reference to the Engraving of Mr. S. Williams' Drag. Plate V.

Fig. 6, an extended view of the drag to a scale of one-eighth of an inch to a foot. The central grapples are nearer together, and also nearer to the chain, than the end ones, they hanging with two links, while the end ones have twelve links.

Fig. 7, a perspective view of one of the grapples, one quarter of the real size.

Fig. 8, a top view of a board, three feet long, having a square hole *g g* sufficiently large to let the grapples come through, and a long slit *h h* for them to hang in.

Fig. 9, a side view of the same, with the grapples and chain hanging in their place; the long folded ropes *i i* are secured to each end of the chain; *j j* a bar of wood to lay over the grapples; it is then tied down, with the chains wrapped round it, and thus renders the grapples portable.

No. XIV.

OPERATING TABLE FOR VETERINARY SURGEONS.

The GOLD VULCAN MEDAL *was this session presented to* JOSEPH GOODWIN, *Esq. Clerk of the Stables, Carlton Palace, for his Operating Table for Veterinary Surgeons; a model of which has been placed in the Society's repository.*

IN the performance of important surgical operations on the human subject, it is considered as a precaution of absolute necessity, that the patient be placed in a position best adapted to the convenience of the surgeon, and his perfect command of the instruments employed by him; and also that the patient be secured by means of ligatures or assistants, or both, so as to control those involuntary struggles which severe pain generally produces, and which, if not resisted, would prevent that accuracy and precision on the part of the surgeon essential in many cases, not only to his success but even to the life of the patient.

The same reasons apply, with still more force, to surgical operations on brute animals, since their struggles cannot be repressed by any consciousness on their part of the intention with which the pain is inflicted. But where the subject of operation is a large and powerful animal, such as the horse, the difficulty of constructing suitable ma-

chinery, as well as the expense, has hitherto induced the veterinary surgeon to content himself with the simplest and cheapest means of attaining his end, not perfectly, but in any tolerable degree consistent with his own personal safety.

Accordingly, the legs of the horse being secured by hobbles, and a halter being passed over his head, he is thrown down in this helpless state on a bed of straw, and the strength of the assistants is relied on to retain him in this position, and to prevent him from injuring either himself or the operator by his struggles.

It sometimes happens, from the momentum and awkward position of the horse in falling, that the back-bone is strained, or even dislocated, or other serious mischief occurs; still more frequently does it happen that the surgeon, being obliged to operate on his knees, or in a stooping, constrained position, and apprehensive, more or less, for his personal safety from the struggles of the animal, either operates imperfectly or erroneously. The sudden convulsive starts also of so strong an animal, when in acute pain, will occasionally overpower the assistants for a moment, and occasion protrusion of the intestines during castration, as well as other mischief.

Induced by these motives, attempts have been made, especially in the cavalry department of the Prussian army, to assimilate the mode of operating on horses to that employed on the human subject, but hitherto with small success.

Mr. Goodwin, having had ample experience during long practice at the royal stables at Carlton Palace of the objections to the common mode, has invented a table for the use of the veterinary surgeon, by which the hazards above-

mentioned appear to be removed. A model of this table has been placed in the Society's repository, to an inspection of which those interested in the subject are invited, it not being conceived possible, without entering into very great detail, to give a satisfactory description, even with the assistance of engravings, of the ingenious and effectual, but complex, mechanism, whereby the objects of the inventor are accomplished.

It may be stated in general, that the table is of wood, large enough to receive a horse conveniently, and of a rectangular figure, rounded at two opposite ends: it is pierced with holes, through which straps may be passed to secure the animal by his limbs, his body, his head, and his neck.

This table is fixed by its centre (on which it is moveable horizontally) in a metal frame, which frame is supported between two upright beams united by a cross piece at top, and to a broad open framed base at bottom.

The metal frame admits of complete rotation around the two horizontal pivots in the upright beams between which it hangs; the table therefore may be placed in a vertical, horizontal, or any other intermediate position. There is also a contrivance for raising or lowering (within certain limits) the points of suspension of the metal frame, and thus of adapting the height of the table above the ground to the convenience of the operator.

The following is the manner in which a horse is placed on the table.

A moveable ledge, two or three feet in width, is fixed to one side of the table, which is then brought into a vertical position, the ledge resting on the ground, and of course horizontal. On this ledge or foot-board the horse, being

previously hobbled, is brought as quietly as possible, so as to be almost in contact with the table. The clothing round his neck has straps fastened to it, which are without loss of time put through the holes in the table, and buckled by an assistant standing on the other side: the fore and hind leg nearest to the table are secured in the same way, as also is the body, by means of two broad bands. The horse is now completely tied to the table; the winches are put in motion, and the table is brought to a horizontal or any other position that the operator chooses; the ledge is then removed, the two legs hobbled, but not strapped down, are committed to the care of the assistants, and all is now ready for the surgeon to begin.

In some cases similar operations are required to be performed on each side of the body, which are by no means easy to effect in the usual way on an animal already terrified, and smarting from the first operation.

For such occurrences Mr. Goodwin has in reserve a table with its metal frame, which being raised by a crane is brought over the horse while he is on the other table, and is secured to the same axis of motion as the former. By means of a second set of straps the animal is fastened to this table also. Then, by causing the two tables to perform half a rotation, that which was the lower now becomes the upper one: the straps that bind the horse to this are unbuckled, the table itself is removed by means of the crane, and the horse now is on the second table, presenting to the operator that side of the body upon which he lay when on the first table.

When the operation is completely finished the table is again brought vertical; the feet of the animal rest on the ground, or on the foot-board, if it should be thought neces-

sary to apply this latter; the straps are unbuckled, and the animal, being released, is led away.

The machine also will be found serviceable in giving physic to untractable horses, or in shoeing them, or in clipping them, an operation which of late has got much into use, as not only improving the appearance of the nimal's coat, but also conducing to his health.

CERTIFICATES.

Charles-street, St. James's,
April 28, 1825.

SIR,

I have attentively examined the operation table invented by Mr. Goodwin, and I am decidedly of opinion that it is admirably well calculated to facilitate the performance of operations on horses, and more especially to enable operations to be performed without the possibility of injuring the animal.

I also think that some of its ingenious principles might be adopted, with advantage, in constructing a table for performing operations on the human body.

A. Aikin, Esq. JAMES WARDROP.
Secretary, &c. &c.

Royal Horse Infirmary, Woolwich,
January 30, 1821.

MY DEAR SIR,

At the time you did me the favour to show me your model for a newly-invented operating table, I confess that I was much pleased with the apparent ingenuity of its mechanism, as well as the effectual means that were pro-

vided for the security of so unmanageable an animal as the horse. You, with myself, as practical men, must be perfectly aware how difficult it is to decide at once on the advantages of a machine of this nature; but from the particular interest I took in my inspection of it, I must say that I augur most favourably of it for the variety of purposes to which the veterinarian may apply it.

I am, Sir,

&c. &c. &c.

Joseph Goodwin, Esq. JOHN PERCIVALL, Sen.

Purley Oaks, near Croydon,

DEAR SIR, January 29, 1822.

You wish to have my opinion of your horse operation table, the model of which you was so kind as to show me the other day. My opinion is, that if it is brought to perform what you propose, it will be of the utmost importance to the veterinary practitioner, as the present method of casting horses for operations is attended with risk and danger, both to the operator and the animal, of which (as you know), in an extensive veterinary practice of more than twenty years, I must have had ample experience. I hope we shall, before long, see one set up in the royal establishment under your superintendance, where, from the value of the animals, the inducement must be the greater to employ it.

I am, Sir,

&c. &c. &c.

Joseph Goodwin, Esq. JAMES HARRISON.

No. XV.

LEVELLING INSTRUMENT.

The GOLD VULCAN MEDAL *was this session presented to Mr.* GEORGE EDWARDS, *of Lynn, Norfolk, for his Klinograph or Levelling Instrument; drawings of which are in the Society's repository.*

SIR, Lynn, April 25, 1826.

I AM desirous of submitting to the approbation of the Society for the encouragement of Arts, Manufactures, and Commerce, a machine which I have invented for taking levels on an entirely new principle, the chief novelty and advantage of which consists in its drawing on paper the section of the ground over which it is moved, to a scale, in which the scale of heights may be equal to that of lengths, or the scale of heights may be greater, so as to show more apparently the inequalities of the surface. But as it would be difficult to convey a correct idea of the machine by drawings and descriptions, if it is thought worthy of the notice of the Society, I will send it up to London as soon as I am informed of their wish to that effect. And as its construction is such as to require taking to pieces for packing, I shall be happy to come to London myself to put it together, and if the committee could inspect it whilst I am in town, I should be able to explain its mode

of operation, which perhaps might not otherwise be clearly understood.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. GEORGE EDWARDS.

Description of a Klinograph, or Levelling Instrument.

The object of this machine is, by driving it before you, to obtain a section on paper of the ground passed over, so as to show, at one view, the inequalities of the surface, and by applying a scale, to ascertain the real elevation of any particular spot. In describing the construction of this machine, of which plate X. is a perspective view, it will be well first to observe its general principle, and afterwards enter into the detailed parts.

The line representing the section of the ground passed over, is described by the revolution of a dotting-wheel of steel, about one inch in diameter, the periphery of which is formed into small sharp teeth, which leave a dotted line, as it is made to revolve on paper strained over a drawing-board. The axis of this wheel is so connected to the machine, that as the latter moves forward on the road, the dotting-wheel revolves on the paper very slowly, leaving a dotted track behind it, the length of which is in exact proportion to the distance passed over by the machine. But the principal object is to give the right direction to the dotting-wheel. This is effected by its being connected with a heavy pendulum, which always hangs perpendicularly, whatever be the position of the machine; so that

when the machine is out of level, owing to the inequalities of the ground, the plane of the dotting-wheel is made to vary in an equal degree from the horizontal line of the paper; and by the combination of these means, the dotting-wheel describes a section exactly proportionate to the length as well as to the vertical elevation and depression of the ground passed over. Thus it appears that the formation of the section line by this machine is dependent upon two motions influencing the dotting-wheel, namely, the rotatory motion, and the direction given to it.

I now proceed to explain the construction of the parts for each purpose, as shown in plate X., which is a perspective view of the instrument; and in plate XI., in which fig. 1 is a plan of the instrument; fig. 2 a side view of the sliding rods, &c., that communicate the motions of the perambulating wheel and of the pendulum to the dotting-wheel; fig. 3 a view from below of the dotting-wheel, showing the situation of the sliding bars, &c. when in an oblique position, the parts being the same as those seen in the right hand end of fig. 2. Fig. 4 a plan or bird's eye view of fig. 2, together with a section of the quadrant and pendulum-rod. Fig. 5, a section of the machine a little within the hind wheels, as shown by the dotted line in fig. 1, projected from the left hand end of fig. 4; *m'* an arm carrying a friction roller to support the arm *l*, and traversing on the bed *r'*, fig. 4.

On the axis of one of the wheels *a* of the machine (which may be called the perambulatory wheel, see plates X. and XI. figs. 1 and 2, and is about two feet eight inches in diameter) a single threaded screw *a* is cut, this drives a wheel *b* of forty-two teeth, a spindle from this wheel is carried up to the body of the machine, and on the

upper end of it is fixed the bevel-wheel *c*, this drives another bevel-wheel *d* of equal diameter, which can be put into gear, when the machine is in use, by the lever *e*, or by the same means may be kept out when the machine is only travelling. At the farther end of this horizontal spindle is fixed a bevel-wheel *f*, which gives motion to an equal bevel *g*, fixed to the short spindle *h*, this spindle terminates in a universal joint *i*, which connects it with the sliding shaft *j*, which is so constructed as to lengthen and shorten as the distance between the universal joints *i* and *k* varies by the motion of the arm *l*. This sliding shaft is connected by the universal joint *k* to the shaft *m*, which is supported at this end, under the bar *n*, by the bearing *o*, and at the other end, where it terminates in another short slide shaft, by the bearing *p* fixed to the revolving arm *q*, and is connected, by a double universal joint, with the dotting-wheel *r*.

Thus by means of the sliding shaft *j*, the rotatory motion is equally conveyed to the dotting-wheel, whether it be on the upper or lower part of the paper; and the bar *n* being jointed to the arm *l* under the cross, allows the dotting-wheel to describe a straight line, or follow the direction given to it, to any part of the paper. The latter part of this description will be better understood by referring to plate XI. fig. 3, where the parts are shown no a larger scale (the same letters being used); and in figs. 2 and 3 will be seen the method of continuing the rotatory motion to the dotting-wheel, when its direction is considerably altered from the horizontal line. The bearing *p* which supports the shaft, turns on the end of a revolving arm *q*, which is moved on a centre *s* by the two connecting rods *t t* fixed to the frame which holds the dotting-wheel; and

as this frame is moved by the pendulum, it at the same time carries out the shaft sufficiently to enable the universal joints to work.

Having now described the means whereby the rotatory motion of the perambulating wheel is transferred to the dotting-wheel, before I describe the other motion, that is, the way in which the right direction is given to the dotting-wheel, I must observe that this machine will not only produce a section exactly similar to the form of the ground, but will also describe a distorted section, *i.e.* one having the scale of height much greater than the scale of length, which is generally done in putting on paper a section taken in the ordinary way by the spirit-level, and is very necessary, where the difference of level is but small, to make it more apparent. My machine, as represented in the plans, is adapted for magnifying the height by six. Having premised thus far, I proceed with the description (see the figs. already referred to, and figs. 4 and 5); *a'* is the axis of the pendulum (if I may call that a pendulum whose office it is to remain perpendicular); *b'* the weight at the bottom, about ten pounds; to the axis is fixed the sector *c'*, which is connected with the pendulum-rod by the adjusting screw *d'*; the bottom of the sector is turned circularly with two grooves on the inside, for catguts, and it may be considered as a part of a large bevel-wheel, the grooves for catgut at the bottom supplying the place of teeth; by these catguts it gives motion to the wheel *e'* (much in the same manner as motion is given from a drill-bow to a drill). The radius of the wheel *e'* is one sixth of the radius of the sector *c'*, so that when the body of the machine is one degree, for instance, out of the horizontal line, in consequence of the road making that angle with the horizon, the wheel *e'* is moved six degrees of a revolution by the action of the

pendulum. On the circumference of the wheel *e'* are fixed, by two screw pins, the connecting rods *f' f'*, which, as the wheel moves one way or the other, give a correspondent motion to the cross *g'*, which gives an equal motion to the rods *h' h'*, which are finally connected with the arms of the cross *i'*, which is attached to the frame *k'*, which holds and directs the axis of the dotting-wheel, causing it to turn on the point in contact with the paper, as the body of the machine varies one way or the other from the level; and by means of this construction of the connecting rods the motion of the pendulum is equally communicated to the dotting-wheel, wherever it be on the paper; the combination of these two motions, therefore, produces a section of the ground in which the scale of height is six times the scale of length.

The brasses which support the axis of the pendulum might be fixed at any height on the rods *l' l'*, so that a part of a wheel of smaller radius may be fixed to the plate of the axis, to give motion to the wheel *e'*, by which means the proportion between the scale of heights and length will be equally altered, and for very steep ascents, by making the wheels *e'* and *c'* of equal diameters, the section may be drawn to the real proportion of height and length; for the same purpose the pendulum rod is so constructed as to be shortened or lengthened as the height of the axis is altered.

v Is a perfectly flat and smooth board for the purpose of pressing on the four springs *n'*, figs. 2 and 4, to keep the dotting-wheel steady on the paper, and is kept at a proper height from the paper by four nuts on the supports *o' o'*, and is retained in that position by means of two spring catches *p' p'*, plate X.

w Is a wheel divided into miles and furlongs, moved by

a screw on the upright spindle, and may be used or not in levelling.

B Is a steering handle on the same axis as the guide-wheel *u*; from this wheel proceed two bands to the other guide-wheel C, which is in connexion with the frame that carries the fore-wheel D; by moving therefore the handle B, a corresponding direction is given to the fore-wheel D, and consequently to the whole machine.

y Is a box formed in the body of the machine, to contain adjusting tools, turnscrews, &c.

I now proceed to describe the management of the machine when in use, and first of its adjustment. The drawing board is fixed to the machine by two steady pins, and one screw nut *x'*, so that it is easily taken off to put fresh paper upon it; this being done, a horizontal line must be drawn along the paper, which is readily done, by applying a ruler to two small pins, projecting from the frame of the board for that purpose; by means of the tightening pins *y' y'* the catguts which connect the pendulum with the wheel *e'* are to be properly strained, the bevel-wheel *d* put in gear, and the screw of the gripe *z* loosened so as to allow the pendulum to act; the dotting-wheel placed on the beginning of the horizontal line, or one parallel to it, the board *v* put on its place, and the guiding-pulley *u* slipped upon its pin; then having marked the place where the machine starts from, it is to be moved forward five or six hundred feet, and returned to the same spot; when, if on examination the line drawn on the paper by the wheel does not terminate upon the line which it began on, the situation of the pendulum with regard to the sector must be changed by the regulating screw *d'*, till, by repeated experiments, it does so end on the line upon which

it began. The machine is then adjusted, and by applying the scale to any elevation or depression afterwards indicated by the machine, it will be shown in feet and inches. If the section required is more than the length of the board will contain, as soon as the dotting-wheel arrives at the end of the paper (which in this machine will be at the end of a quarter of a mile), the board *v* must be taken off, and the dotting-wheel returned to the other end, then replacing the board, go on again. Afterwards, by adding up the rise or fall of each line, the difference of level between the two extremes is obtained, and the paper being taken off the board, all the lines may be transferred in succession, by pricking through to a long strip of paper which will exhibit the whole section.

Fig. 6 a side elevation of the dotting-wheel, and of the cross *i'*.

Fig. 7 a side view of the cross *i'*.

Figs. 8 and 9 a side and an end view of the frame *k'* which carries the dotting-wheel. Its spindle passes through a socket in the centre of the crosss *i'*, and is secured in its place by a set-screw.

Figs. 10 and 11 a side and an end view of the dotting-wheel with its axle.

Fig. 12 a side elevation of that part of the plate *n* which is below the cross *i'*, together with the revolving arm *q*, and its bearing *p*, and one of the rods *t* which connect the revolving arm with the frame of the dotting-wheel.

Fig. 13 a view of fig. 12 seen from below. The spindle of the frame *k'*, fig. 8, passes through, and is at liberty to move in the round hole *s'* in the end of the plate *n* previous to entering the socket of the cross *i'*. The small connecting rods *t t* are fixed by one end on the upper part of the

frame k', at right angles to the axis of the dotting-wheel, and by their other end on the revolving arm q, and thus change the angle of inclination of the dotting-wheel according to the motion of the pendulum.

I cannot conclude this description without mentioning two improvements which I should have made use of, had I had time before I submitted my machine to the approbation of the Society. One consists in putting two wheels before as well as behind; thus I should avoid a considerable source of error in the machine as it is at present, owing to the fore-wheel being affected by the convexity of the road. The other is, instead of paper on a drawing board as at present, I propose using a long slip of stout paper, or paper on canvass, strained upon a roller at each end of the drawing board, and confined laterally in a groove for that purpose; then as soon as the dotting-wheel had travelled from one roller to the other, whilst the paper on one roller is slackened, it should be wound upon the other; by this means the section would be produced in one continued line, and there would be less trouble in shifting the dotting-wheel.

G. E.

No. XVI.

DRY GRINDING.

The GOLD VULCAN MEDAL *was this session presented to* ROBERT COWEN, *Esq., of Carlisle, for his improved method of carrying off the Dust produced in grinding Cotton Cards. A model of the machine has been placed in the Society's repository.*

SIR, Carlisle, March 1, 1824.

HAVING frequently witnessed the very injurious effects of the dust and particles of emery and iron produced in the operations of dry grinding, on the health of persons employed in cotton mills, induced me, several years ago, to attempt means to remove the evil; and for that purpose, in the year 1817, I constructed a grinding machine, with tubes for conveying away the particles of iron and other dust, similar in principle, with the exception of the fan, to the accompanying sketch and model. On a little experience, however, with the machine, without a fan, I found the current of air produced by the velocity of the cylinder and brush insufficient, being frequently counteracted by sudden gusts of wind, and other causes, by which the dust was thrown back into the room. To remedy this defect I afterwards adopted the fan at the extremity of the tube, which, under every circumstance, in this as well as in other machines requiring a much more powerful draught

of air, wherein a modification of the same principle had been tried, completely answered my expectations. It is obvious that the same principle may be applied, with facility, to every description of dry grinding and ventilation, where power is to be obtained. I shall feel obliged by your submitting the plan and model to the inspection of the Society; and should they be approved of, and meet the approbation of the Society, and obtain, through the medium of their Transactions, to more general utility, my object will be fully attained.

I am, Sir,

&c. &c. &c.

ROBERT COWEN.

A. Aikin, Esq.
Secretary, &c. &c.

CERTIFICATES.

SIR, Carlisle, Feb. 25, 1824.

It is a truly gratifying pleasure to witness any improvement calculated to ameliorate the condition of those people whose avocations are so destructive of health. Scarcely can any employment be conceived more injurious than dry grinding, in the way in which it is usually performed. Mr. Cowen's invention, I am happy to say, from my own observations, and from the evidence of those employed at the machine, affords the most satisfactory proof of its efficacy in removing all danger of injurious consequences from those people who are employed in dry grinding.

I am, Sir,

&c. &c. &c.

JOSHUA ANDERSON,
Surgeon.

A. Aikin, Esq.
Secretary, &c. &c.

SIR,

I have superintended, for six or seven years, the machine invented by Mr. Cowen for carrying off the dust, &c., during the operation of dry grinding. Previous to the introduction of the fan I experienced great inconvenience from the dust, being afflicted with an asthmatic complaint; but since it was added the current of air so effectually takes along with it all dust produced in the operations of brushing and grinding the cards, that no inconvenience is ever felt from it. I therefore consider myself authorized to give my grateful testimony in favour of Mr. Cowen's machine for dry grinding.

I am, Sir,

&c. &c. &c.

JAMES MILLIGAN.

A. Aikin, Esq.
Secretary, &c. &c.

The wire cards employed in carding cotton previous to the process of roving, require to be ground from time to time, as the points of the wires get blunted by continual use. This must necessarily be done dry, as wet grinding would cause the wires to rust: but the particles of iron and of emery which are mutually detached by this operation produce a cloud of fine dust, which, being inhaled by the workman in the act of breathing, is taken into and deposited in the windpipe, and passes into the lungs, and thus produces much irritation, and ultimately incurable disease of the latter. In order to prevent the workman from being thus annoyed, various contrivances for carrying off the dust, and adapted to different kinds of dry grinding, have

been proposed to the Society. Several of these have been rewarded and published, as calculated, more or less, to produce the desired effect; and to these is now added Mr. Cowen's machine for grinding cards, in which the apparatus for carrying off the dust is very simple, and appears to have been completely successful.

The entire machine is represented in plate VI. in which fig. 1 is a plan, fig. 2 a side elevation, fig. 3 a section, and fig. 4 a front elevation.

Before a card is ground it is first laid with the wires downwards in the slit of the cylindrical case *f f*, figs. 1 and 3, where it is cleaned from dust and the adhering fibres of cotton, by the action of the cylindrical brush within the case: the air is drawn in at the same time, as represented by the arrow, passes along the trunk *i i*, and thence into the fan case *h h*, from the mouth of which *j* it is discharged into the open air, together with the dust and filaments of cotton.

Being thus cleaned, the card is next ground. *a a*, fig. 3, is a drum covered with emery, which forms the grinding cylinder; this is surrounded by a case *b*, having a longitudinal opening *c c* of the same length as the drum (see fig. 4). Through this opening the card *d* is applied to the grinding cylinder, which by its revolution not only sharpens the card wires, but (assisted by the action of the fan) draws in at the same time a current of air, indicated by the left hand arrow, figs. 2 and 3: the air passes down between the cylinder and its case, then rising up through the passage or flue enters the fan case, and is discharged at *j* into the open air, carrying with it the whole of the dust produced in the grinding.

The moving power is applied to the wheel *v*, fixed on

the axis of the grinding cylinder, from which a strap *w*, fig. 3, passes over the wheel *x* on one end of the axis of the brush *g*, while on the other end of the axis a similar wheel is fixed, connected by means of the cord *y*, figs. 1 and 2, with a wheel on the axis of the fan.

The medal of the Society was given for that part of the machine which has now been described; but as considerable ingenuity is displayed in the mode by which certain motions are given to the card while grinding, an explanation of this part also will, it is hoped, not be unacceptable to the reader.

It is evident that if the card, while grinding, were kept in the same position with regard to the drum *a*, its surface would be brought to a concave form, the curvature of which would correspond with that of the drum. But as a card of this figure would answer its intended purpose very imperfectly, it is necessary to have recourse to some means by which the surface may be ground level. This is found to be effected by giving the card a curvilinear motion, by the union of two movements, one up and down, the other alternate lateral.

At one end of the axis of the grinding cylinder is fixed a pinion, that takes into a toothed wheel, to which is attached the heart *l*, fig. 2; by means of this an alternate lateral motion will be given to the horizontal bar *m*, which motion is conveyed to the bar *o* through the connecting lever bar *n*; the fulcrum of this latter is the square end of a horizontal bar *r r*, fig. 4, to the other end of which is attached a short bar, which is connected by a joint with the horizontal bar *o*, fig. 3. Thus the two horizontal bars *o o* move equally backwards and forwards in the eyes or guides which support them. On these bars rest the two

legs *p p* of the card holder; and as this is kept pressed against the grinding cylinder by the action of a spring, it is manifest that the holder, and consequently the card itself will receive an alternate up and down motion, in proportion as the bars *o o* move backwards and forwards.

Below the machine is the small round plate *u*, fig. 2, which is turned round by means of the strap *z z*, fig. 3, that connects it with the axis *v* of the grinding drum: this plate (see *u*, fig. 4) is placed oblique, and enters the notched end of the lever bar *t*, fig. 4; this latter, therefore, receives an alternate lateral motion from the revolution of the plate, which motion is transferred to the card-holder, by slipping the eye at the upper end of the bar over a pin projecting from the cross-bar of the card-holder. The spring that keeps the card-holder, and consequently the card, pressed against the grinding-drum, is fixed to the fore part of the lever bar *t*, and presses by its free end on the back of the card *d*.

Instead of the spring, an adjustable lever, fig. 5, may be used, or the apparatus, fig. 6, which differs from the preceding in having a treadle and two cranked arms for the convenience of withdrawing the holder, in order to take out or put in a card.

No. XVII.

CUPPING APPARATUS.

The SILVER VULCAN MEDAL *was this session presented to Mr. J. P.* CLARK, *5, King-street, Holborn, for his Cupping Apparatus. The following communication has been received from him on the subject, and a specimen of his invention has been placed in the Society's repository.*

5, King-street, Holborn,
Jan. 30, 1826.

SIR,

IN compliance with the regulations of the Society for the encouragement of Arts, &c., I have given in to the housekeeper a model of my little improvement on the cupping apparatus, accompanied with a certificate from Sir Everard Home, Bart., expressive of his opinion of its importance. I have also inclosed a short description of it, with some remarks on the merits to which it professes to lay claim. Mr. Carpue has seen it, and will be ready, whenever you find it convenient, to express his opinion of the apparatus.

I am, Sir,
&c. &c. &c.
J. P. CLARK.

A. Aikin, Esq.
Secretary, &c. &c.

5, King-street, Holborn,
Jan. 28, 1826.

Sir,

In compliance with the advice of several of the most eminent medical gentlemen in London, I have ventured to request that you will have the kindness to submit to the consideration and protection of the Society for the encouragement of Arts, &c., the accompanying cupping apparatus which I have lately invented.

The importance of cupping, as a surgical operation, is fully admitted by every medical practitioner; while it is well known that, from the difficulty experienced in fixing the glasses effectively in the ordinary way, few surgeons ever attempt performing the operation. Hence it is that in London, and other large cities, cupping has become a distinct profession. In the army and navy, and in the country generally, the want of expert cuppers is felt as a serious inconvenience. I am at liberty, from the highest medical authority, to state, that every reasonable effort has been made to render the army surgeons expert cuppers; but that this being found impracticable, the further prosecution of the design had for the present been abandoned. I have the satisfaction of being able to state, from the same authority, that my little invention completely removes the difficulty, and that it will be introduced among the army surgeons forthwith.

As all those who have written on the art of cupping are agreed as to the difficulty of managing the glasses, I shall take the liberty of stating here what Mr. Weiss has written on the subject.

"Cupping," says Mr. Weiss, "has not acquired that extensive and general use which its benefits entitle it to,

from the acknowledged difficulties of the art of employing the ordinary cupping apparatus, unless the cupper be engaged in constant practice, and thus acquire and maintain great dexterity, particularly in the management and application of the glasses. This constant practice is so essentially necessary, that the assistant surgeons of some large institutions at a distance from town, to whose duty cupping devolves, are obliged to practise dry cupping on themselves to preserve their skill; and many country practitioners are obliged to abandon the remedy altogether."

The new apparatus now submitted to the Society completely removes all these difficulties, by the extreme simplicity of its construction and application; and it will add very little to the usual expense.

The accompanying certificate, kindly and handsomely offered by Sir Everard Home, Bart., when he first saw my cupping glass applied, contains also the sentiments expressed by every medical gentleman who has yet seen it; among whom I have the honour to reckon Sir Astley Cooper, Bart., Sir James M'Gregor, Sir William Franklin, Con. Carpue, Esq., Peter M'Gregor, Esq., &c. &c.

I am, Sir,

&c. &c. &c.

J. P. Clark.

A. Aikin, Esq.
Secretary, &c. &c.

Description of the Cupping Apparatus lately invented by Mr. Clark, Cupper.

Unlike every other apparatus used for fixing the cups, Mr. Clark's contains the principle of exhaustion within the

glass itself; and as flame only ascends, it never can burn, except from carelessness, the part to be cupped. Each of the glasses is furnished with a semicircular hoop of silver, sufficiently elastic to adapt itself readily to the internal form of the glass. Both ends of the hoop are covered with a small piece of leather, to render it more steady. The apparatus is readily transferred from one glass to another of nearly the same size, and will last a lifetime. In the centre of the hoop there is a small tube, for the reception of a silver pin. The pin is formed with a spring on the upper end, where it enters the tube; its other end terminates in a small moveable ring, which retains a sponge, or any other proper substance, and yet readily gives way to the skin, should it rise so high within the glass. This pin is easily removed, and its place supplied by a fresh one every time the glass is removed from the skin. Two or three applications are generally sufficient during one operation, so that eight pins may be considered a sufficient complement for six glasses.

The advantage of this method of cupping is, that any one may readily perform it without the least difficulty.

Fig. 1. *Fig.* 2.

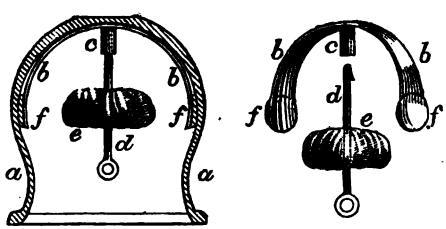


Fig. 1, *a a* a section of the cupping-glass; *b b* a silver spring fitting within it, and having a socket *c* in the centre;

d a silver pin fitting into the socket; *e* a piece of sponge on the pin *d*, to hold the spirits.

Fig. 2, the spring and pin *d* separated, and without the glass; *ff* bits of leather cemented on to the ends of the spring, to make it hold in better and go in and out easier.

CERTIFICATE.

Sackville-street, Jan. 26, 1826.

This is to certify, that I have examined the new invention of Mr. J. P. Clark, which appears to me simple, ingenious, and useful, in the greatest degree, for the purpose of cupping; I have therefore recommended him to bring it under the observation and protection of the Society for the encouragement of Arts.

EVERARD HOME.

No. XVIII.

HAND-RAIL SECTOR.

The LARGE SILVER MEDAL was this session presented to Mr. C. HARTLEY, 4, Essex-street, Battle-bridge, for a Hand-rail Sector; a model of which has been placed in the Society's repository.

SIR, 4, Essex-street, Battle-bridge.

I BEG leave to lay before the Society of Arts, &c. a model and drawings of an instrument of my invention, which I

call a hand-rail sector. It will be found important in its application, though so simple in its principle, that it may be made and applied at a trifling expense by any mechanic whether in the practise of hand-railing or not.

The method of squaring hand-rails has been attempted by many; but no one, except Mr. P. Nicholson, whose name is so well known as a superior geometrician, ever explained or brought it to the correctness necessary for getting out the face mould.

The only inconvenience in Mr. Nicholson's method is the great number of lines to be drawn before the face mould can be got correct, so much so, that a workman, however familiar with it, is subject to mistakes entirely on account of the multiplicity of lines.

My idea is to bring this part of geometry into mechanism as much as possible, in order to prevent mistakes; and this end I hope will be found to be attained by the instrument herewith sent.

Its advantages are not confined to hand-railing alone, but may be extended to stonemasonry, or any work of double curvature, whereby much time will be saved as well as materials.

I am, Sir,

&c. &c. &c.

CHRISTOPHER HARTLEY.

A. Aikin, Esq.
Secretary, &c. &c.

CERTIFICATE.

James-street East, Chelsea,
March 22, 1826.

SIR,

I made an instrument from C. Hartley's model of his hand-rail sector about eighteen months since. I have struck

the moulds for the handrails of twelve different staircases, and find I can strike them out in one-tenth of the time, and with more correctness; I can also get the rail out of thinner stuff.

I am, Sir,
&c. &c. &c.
J. ROBSON.

A. Aikin, Esq.
Secretary, &c &c.

To render the following description of the instrument as popular as possible, the attention of the reader must be directed to those staircases in which the winders or triangular steps encompass a circular space which is called the well hole. The hand-rail forms the fence to the well hole, enclosing therefore horizontally a circular opening, and rising vertically at the same time to correspond with the rise of the stairs. This portion of the rail is in fact precisely similar to a portion of the thread of a common cork-screw, greatly magnified, of which a little reflection will show that no four points in the same revolution can be in the same plane.

In practise, however, economy as well as convenience demands that the mahogany or other material out of which the handrail is to be manufactured, should be cut into planes or planks of not much greater thickness than the intended substance of the rail. To cut these planes or planks of mahogany into a spiral form, with as little waste of material and labour as possible, is a great desideratum, and the means of doing it has generally been a nostrum in the hands of a few journeymen, possessing greater skill or intelligence than their fellows, and who have thereby enjoyed a sort of monopoly, frequently injurious, and very

often vexatious, to their employers. The attempts to remedy this evil by the invention and publication of refined geometrical methods, ingenious and beautiful as they are, have been, as might be expected, totally useless, the methods having been utterly beyond the reach of the most intelligent of those to whom they were addressed, and much too tedious and complicated for the use of a workman.

To provide a sufficiently accurate mechanical substitute for these more perfect but impracticable methods, is the object of the present invention, which places an approximate solution of this difficult problem within the power of any artisan of ordinary dexterity and application.

The most common form of a well hole is that of a long parallelogram, with a semicircle at each end, and to this form the present description will be applied. Fig. 5 in the print will represent the semicircle at one end of such a parallelogram divided into equal parts at the line No. 3, at which place there is always a joint in the rail, the mahogany forming only a quadrant in one piece. Suppose No. 1 to be the lowest point of the semicircle, No. 2 will be the highest, and No. 3 an intermediate point. The instrument shown in a plan and view, figs. 1 and 2, finds the form of only one quadrant of the rail at a time, say from No. 1 to No. 3, and it is thus adjusted to the operation.

The centre of the upright circular shaft *c c*, fig. 1, is made to coincide with the intersection of two of the lines on the base of the instrument, whose numbers express the diameter of the well hole in inches, those lines being marked

from six to twenty-two or more for this purpose. To facilitate this adjustment, the shaft *c c* is fixed to a horizontal slider *b*, which is secured by a screw *d*. In the print the centre of the shaft is at the intersection of the lines 18, 18, our imaginary well hole being eighteen inches in diameter; *e e e* are three square tubes containing three sliding stems *f f f*, Nos. 1, 2, and 3, which terminate in sharp steel points at top, and which may be fixed at any elevation in their respective tubes by the screws *g g g*. The place of the middle one of these tubes and stems is constant, the others are placed on those lines at whose intersection the shaft *c c* stands. The tubes always stand in some part of the lines *e e*, which connect them, and the distance of the lines 6, 8, 10, &c. is so arranged, that the distance between the moveable tubes and the shaft is always 3, 4, 5, &c. inches, being the radius of the well hole of which the numbers on the base indicate the diameter. The three tubes and the shaft therefore always form a square, which inscribes a quadrant of the well hole, *c* being the centre, and the two moveable tubes corresponding with the points No. 1 and No. 3 in fig. 5.

To adjust the height of the stems *f f f*, reference must be had to fig. 4, which represents what is called the *falling mould*, being an upright section of the rail developed from its circular plan, and exhibiting the rapidity of its rise or inclination from the horizon at every part. The falling mould is divided at No. 3, in accordance with the similar point on the plan fig. 5, and the space between Nos. 1 and 3 is again divided at *m*; *l m* and *m n* are then drawn so as to give the average inclination of the mould; that is, they are tangents to the mould at the middle of their lengths respectively. A bevel is then set to the angle which *l m*

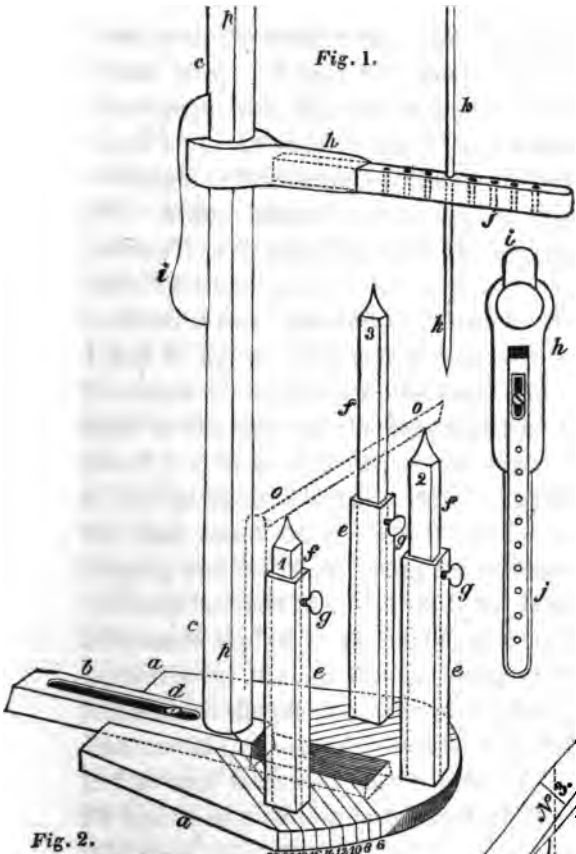


Fig. 1.
Fig. 3.
Fig. 4.
Fig. 2.
Fig. 5.
№ 1.
№ 2.
№ 3.

forms with the vertical line, and then being applied to the square stems *f* 1 and *f* 2, their tops are set to form the same angle with the perpendicular. The bevel is afterwards set to the angle made by *m n* with the vertical, and this angle in like manner regulates the height of *f* 3 above *f* 2. A thin board is now to be laid resting on the three points *f* 1, *f* 2, and *f* 3, while the pencil *k k*, fixed in the arms *h j*, which revolves freely round the shaft *p*, is made to describe two quadrants of different radii, similar to Nos. 1 and 3, fig. 5. The pencil may be fixed to any radius by means of the holes in the arm, and it accommodates itself to the slope of the thin board by the power of the arm *h j*, to slide vertically on the shaft, in which motion it is kept steady by the guide *i*. The lines described on the thin board by the pencil will be two quadrants of ellipses, and the board being cut in these lines, the space enclosed between them is called the *face mould*, which is afterwards applied to the mahogany, and guides the saw in cutting it; the saw always cutting at the same angle in reference to the plank, as the pencil has formed with the face mould; or, in other words, it is cut as if the plank had at once been laid on the points *fff*, and the pencil *k k* had been a cutting instrument which pierced its whole thickness.

The other quadrant from No. 2 to No. 3 is exactly the reverse of this, and is found without the assistance of the instrument.

The piece thus cut out of the plank requires only to be dressed into the desired form of the hand-rail, a process which must depend upon the eye of the workman, but which is of little difficulty compared with what has been effected by the instrument.

In order to cut the ends of this piece so as to make accurate joints with the other parts of the rail, care must be taken before the face mould is removed from the points *fff* to mark its surface with two lines exactly and vertically over 18, 18, or those on which the tubes and stems 1 and 3 stand. To facilitate this, two lines are drawn on the stem *c c*, one of which *p p* is seen, and which contain between them an exact quadrant; a straight edge then being placed with its edge coincident with the end of the line 18 on which the tube stands, and ranged out of winding with the line *p p*, will be a guide for one end, and the line *p p* a guide for the other end of a ruler which will describe the line required.

Fig. 3 shows the underside of the arm detached from the shafts, by which it will be seen to possess a power of minute adjustment as to length, independent of the holes which receive the pencil.

Fig. 2 is a plan of the base of fig. 1.

No. XIX.

CURVILINEAD.

The sum of FIVE GUINEAS *was this session presented to Mr.* JAMES ALDERSON, *of Bridge-row, Pimlico, for a Curvilinead, or Instrument for describing Arcs, the Centres of which are not given. The following communication was received from the candidate, and his instrument has been placed in the Society's repository.*

4, Bridge-Row, Pimlico,
March 20, 1826.

SIR,

HEREWITH I beg leave to submit for the approbation of the Society of Arts, &c. a mathematical instrument of my invention called a curvilinead, wherewith to describe regular curve lines, or portions of circles of any diameter, with ease, accuracy, and dispatch.

In my professional avocations as a mechanical and architectural draftsman, I have frequently had occasion to lament the want of such an instrument as this, which is, I trust, perfectly adapted to all the purposes of a drawing-board that practical draftsmen can require for truly delineating segments of circles.

The arms of the instrument *a a*, figs. 1, 2, 3, plate I., are formed of two pieces of well seasoned mahogany, two feet two inches long, one inch broad, and three quarters of an inch thick; but they may be made to any dimensions

as convenience or necessity may dictate. These arms are connected at one end by a brass joint, one-eighth of an inch thick, let into the wood flush with their upper surface. The grooves *b b* in the under surface of the arms, if continued, will intersect each other at the angle, and coincide in the centre of the joint; which, by the curved form given to the end of the sliding bar *j j*, fig. 3, is also the point of the pen or pencil *l*. By this means the segment of a circle of any diameter may be accurately delineated from three given points; namely, the extremities of the chord line of the arc to be described, and the sagitta or rise of the arch; or, indeed, through any three given points within the compass of the instrument.

The index mark *f*, fig. 1, is fixed exactly over the middle of the groove *b b* in the under side of the leg, and by means of the graduated semicircle *d d*, shows the angular distance of the two grooves. The instrument cannot be set to a less angle than 60°, see fig. 2, nor is it necessary, as it will at that angle describe an arc equal to three quarters of a circle. The steel screw *p*, figs. 2 and 3, connects the brass joint at the angle, and also perforates and fixes perpendicular thereto the swivel box *i* wherein the bar *j j* slides. When this screw is taken out, the two legs may be brought parallel to each other, and in this state the instrument is rendered very conveniently portable. The other swivel-box *h*, through which the bar *j j* also slides, forms the joint of the two arms *g g* by a similar screw *p*; which are thus enabled to adapt themselves to whatever angle the instrument may be opened to; at the same time, by means of their bearings *q q* on the legs *a a*, they keep the bar perfectly steady.

In order to prepare the instrument for use, the legs are

to be extended to the required angle, and are secured in that position by tightening the binding screw *e*, as well as the screws *q q*; the sliding bar *j j* is then to be adjusted so that the point of the pen or pencil *l*, fig. 3, shall coincide with the prolonged axis of the screw *p*, and it is to be secured in this position by the binding screws *k k* of the swivel boxes *i i*. When the angle is to be changed, all these screws must be previously loosened, a precaution which must be carefully attended to, lest the instrument should be strained or broken.

At the near end of the sliding bar is a vertical hole for the reception of a round pointed peg *r*, fig. 3, of wood, ivory, or metal, just long enough to touch the paper on which the arc is to be described. It serves to preserve the horizontal position of the bar, and affords much facility in working the instrument.

o o fig. 1, Are two plates or carriages that support the swivel roller *c c*, which take into the grooves *b b*, and on which the instrument traverses. The various parts of the roller, with its carriage, are shown combined in fig. 3, and separate in section in fig. 5; *a* one of the legs, *b* the groove, *c* the roller, *m* the cheeks between which it hangs, *o* the plate, *n* a point projecting from the under side of the plate, in order to fix it in the drawing-board.

Fig. 4 shows separate the parts which unite at the joint or angle of the instrument.

Parallel arcs being sometimes required, these may readily be drawn by this instrument, by first describing the interior arc, and then sliding the bar *j*, and consequently the pen or pencil that it carries, so far beyond the angle of the instrument as corresponds with the required distance between the two arcs, and then describing the exterior one. Such

arcs, it is true, are not strictly parallel, because the centre of the exterior curve advances a little beyond that of the interior one; but where only small arcs are wanted, the error, practically speaking, is imperceptible. If large arcs with considerable distances between them are required, other methods must be had recourse to.

The semicircle or protractor is divided into one hundred and eighty equal parts, each of which is to be considered as *two* degrees. Therefore, in estimating the quantity contained in an arc described, care must be taken to reckon from zero on the *outer* graduation, towards the index. Thus, if the index stands at 50°, 60° or 70°, the arcs described contain respectively 100°, 120°, and 140°.

To obviate the apparent necessity of placing the centre pins at the extremities of the required arc, I would refer the practical draftsman to the two very useful problems in Mr. P. Nicholson's Builders' Directory; namely, prob. 58, p. 58, and prob. 37, p. 39; whereby it is demonstrated, that the points may be placed at the extremities of the paper, and the same arc will be produced.

The same problems also demonstrate that the segment of a circle required may be described and continued to any extent, by this instrument, without increasing the length of the arms; all that is necessary being merely to find different points through which the arc required is to pass.

Finally, I have to state that the instrument possesses the property of describing spiral and irregular curve lines, both curious and useful, by varying and altering the position of the pen or pencil from the centre. This property I did not contemplate in the first instance, and it is probable there may be many others of which I am not aware.

But as I have already exceeded the usual limits, I respectfully forbear further to expatiate, and remain,

Sir,

A. Aikin, Esq. Your's, &c.
Secretary, &c. &c. JAMES ALDERSON.

P.S. Mr. Lealand, mathematical instrument maker, 24, Clarendon-street, Somers-town, will make similar instruments to this for 2*l.* each.

CERTIFICATES.

SIR, London, March 27, 1826.

I have seen Mr. Alderson's instrument for describing the segments of circles, and have no hesitation in saying that it is the most perfect of the kind that I have seen.

A. Aikin, Esq. PETER NICHOLSON.
Secretary, &c. &c.

SIR, Navy Office, March 28, 1826.

I have inspected the instrument invented by Mr. Alderson, and consider it a very valuable invention, particularly for describing circles, or segments of large radius.

A. Aikin, Esq. GEO. L. TAYLOR,
Secretary, &c. &c. *Surveyor of Buildings.*

Sir, Lambeth, March 26, 1826.

I have examined the instrument invented by Mr. Alderson for producing curved and straight lines, I believe it will prove a most valuable instrument for the purposes intended, and I feel no hesitation in saying I think it the best of its kind I have ever seen.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. HENRY MAUDSLAY.

Sir, Navy Office, March 28, 1826.

I have inspected the instrument for drawing circles of a great radius, invented by Mr. Alderson, and consider it one of the best I have seen for that purpose.

WM. MILLER.

A. Aikin, Esq. *Assessor to the Surveyor of*

Secretary, &c. &c. *Buildings.*

Bridge-street, Blackfriars,

Sir, March 29, 1826.

Having examined and tried Mr. J. Alderson's instrument for striking segments of circles upon a large scale, I feel no hesitation in saying that it is the best instrument I have yet seen for producing the proposed effect.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. M. I. BRUNEL.

No. XX.

STATICAL HYDRAULIC ENGINE.

The THANKS *of the Society were this session voted to Mr.* GEORGE MANWARING, *Engineer, Marsh-place, Lambeth, for presenting to the Society, and allowing them to publish, a description of his Statical Hydraulic Engine.*

IN the fifth volume of the Society's Transactions is a description, by the late Mr. Smeaton, of a statical hydraulic engine, invented by Mr. Wm. Westgarth, and rewarded by the Society in 1769. The attention of the Society being particularly directed last session to the working model of the above engine placed in their repository, the same was referred to the consideration of a committee.

At one of the meetings on this subject, it being stated that Mr. Manwaring had some years ago erected, near Whitby, an improved engine, on the principle of Mr. Westgarth's, it was recommended to the Society to make application to Mr. Manwaring to furnish them, at their expense, with a drawing or model of the engine so improved by him. With this request Mr. Manwaring very obligingly complied, by offering to the acceptance of the Society a drawing of his engine, and allowing them to insert a representation and description thereof in the next volume of the Transactions.

Description of a Statical Hydraulic Engine, erected by Mr. Manwaring, for Messrs. Cook and Co., at their Alum Works, near Whitby, in the year 1812.

In the common steam-engine the prime mover is a piston-rod, alternately rising and falling in a cylinder, in consequence of the elasticity of steam let into the cylinder, alternately above and below the piston.

In the statical hydraulic engine the prime mover is exactly the same as in the steam-engine; but the motion given to the piston-rod is by means of the statical pressure of a column of water, applied alternately above and below the piston.

In plate IX. is a representation of the engine. A is the pipe by which the supply of water is brought from a head, one hundred and seventy feet above the engine; B is a vessel containing air, the continual elastic pressure of which prevents the blow that would otherwise be occasioned by the descent of the water; C is a throttle valve; *d d* is a hollow open cylinder, working within an exterior one, and closely applied to that cylinder at the parts *e e*, *e e*, but elsewhere leaving a vacant space between the two cylinders for the reception of the water; *h h* are packings, in order to prevent the escape of the water between the two cylinders; and *i i* are adjusting screws, to tighten the packing in proportion as it is worn away: *f f* are two passages that lead into the upper and lower ends of the pipe *g*, in which the piston *w* works.

When the cylinder *d d* is in the position represented in the plate the communication is open, by means of the upper pipe *f*, for the water to flow into the pipe *g*, *above*

the piston *w*; at the same time the passage is open for the water in the cylinder *g*, *below* the piston, to flow out, through the lower pipe *f*, and through the lower part of the open cylinder *d*, into the pipe *x*, which is somewhat more than thirty feet long, and terminates in a cistern of water. There is, therefore, above the piston *w* a hydrostatic pressure, equal to one hundred and seventy feet of water, and below it a partial vacuum; the piston consequently descends to the bottom of the pipe *g*. By the time that it has arrived in this position the cylinder *d* will also have descended so far as to have opened the communication between the entering water and the lower pipe *f*, and to have shut off its communication with the upper pipe *f*; the hydrostatic pressure is therefore transferred to the under part of the piston, which consequently rises, while the water above the piston pours into the top of the cylinder *d*, and escapes through the pipe *x*.

The alternate motion of the slide or cylinder *d* is thus effected. The rod of the piston *w* is attached at its top to one end of the beam; at the other end of the beam is a rod, terminating below in the crank *m*: the oscillating motion of this crank is transferred, by means of the connecting bar *l*, to the axis *k*, on which is placed the curved tooth or cam *n*: this latter is inclosed within the rectangular frame (or cam-box) *j*, and being moveable in a horizontal position, is consequently made to perform a backward and forward motion, by the cam pressing first on one and then on the other side of the box. To the outside of the box are fixed two guide-bars, supported on the bearings *o o*: the connecting rod *p* is fastened at one end to the guide-bar, and at the other end to the arm *q* of a bent lever, having for its fulcrum the pivot *r*: the other

end of the lever is forked, and embraces the pipe *x*: one of these forks *s* is connected with the lower end of the upright rod *t*, and the other fork is connected with a similar rod. These rods are fastened at top, to the two ends of a cross-bar, to the middle of which is fixed the rod *u*, which works in the stuffing-box *v*, and gives motion to the slide *d*.

The slide remains stationary nearly half a stroke of the piston, in order to allow the water to act with its full force; and this is effected by its being necessary for the cam, after it has moved the box in one direction, to perform about a quarter of a revolution before it can act on the opposite side of the box.

The reason for making the passages *ff* as large as represented is, to diminish as much as possible the friction of the water, which otherwise would retard the motion of the piston.

No. XXI.

CRANIOTOMY FORCEPS.

The GOLD VULCAN MEDAL *of the Society was this session presented to* JOHN POCOCK HOLMES, *Esq., for a Craniotomy Forceps. The following communication has been received from the candidate on the subject, and the instrument has been placed in the Society's repository.*

SIR, Old Fish-street, May 26, 1826.

I HAVE the honour to acknowledge the receipt of your letter of the 29th ultimo, announcing to me the reward which the Society for the encouragement of Arts, Manufactures, &c., have been pleased to confer on me for my craniotomy forceps, on condition of my leaving a model, with a description thereof, and of my relinquishing all pretensions to a patent.

I therefore have the pleasure of sending herewith two pair of forceps (the one adapted for external, the other for internal application), and beg to say that I cheerfully relinquish all claims to a patent.

One case of the application of my instrument was witnessed by Mr. Field, and is referred to in the certificate of that gentleman which I had the honour to lay before the Society; and another subsequent case has occurred equally successful.

To enlarge on an instrument used for such delicate purposes, when every feeling heart must deplore the necessity for its use at all, would be superfluous; and, in a volume intended for the general reader, highly improper. I will therefore content myself with giving a proper reference to the plate. I shall feel honoured in rendering any assistance which may be required.

As I presume the Society will publish some of the numerous certificates which I had the honour to hand to you, from the eminent professional men and practitioners in midwifery, may I be allowed particularly to request that the certificate of Sir Astley P. Cooper, Bart. may be published, as that scientific surgeon very ably points out the application of my invention to cases of lithotomy as well as craniotomy.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. JOHN POCOCK HOLMES.

Reference to the figures of Mr. Holmes's Forceps.
Plate VIII.

Fig. 1 is a view of the entire instrument; fig. 4 shows the two parts disunited: *e e* is the convex blade, perforated with holes, for the purpose of receiving the teeth when the instrument is in action: *a a* is the concave, spoon-like blade, in the hollow of which the toothed lever *b*, fig. 5, is lodged. This toothed lever works on the screwed pin or fulcrum *c*, and its unarmed end rests on the spring *d*, fig. 6. The natural action of this spring is, by raising the end that

rests on it, to depress the opposite armed end, so that the points of the teeth lie just within the margin *g g*, fig. 2, of the hollow blade; this part of the forceps may therefore be introduced separately, with scarcely more risk of injury to the patient than a plain solid blade. The other part of the forceps, namely the convex perforated blade, is next to be introduced; the two parts then are to be united, as in fig. 1, and pressure is to be made on the handles. The consequence will be, that the part *f* of the blade *e e* will bear on the unarmed end of the lever, and will depress it, by overcoming the resistance of the spring; the armed end will consequently rise above the margin of the hollow blade, as shown in fig. 3, and will thus give the practitioner a firm hold of whatever may be intercepted between the two blades of the forceps. Fig. 7 is a modification of the instrument, in which the perforated blade is the convex one, and the armed blade is the concave one.

CERTIFICATES.

April 10, 1826.

I am little a judge in such matters, but the instrument of Mr. Holmes appears to me to be safe and ingenious.

I am of opinion that it might be safely and effectually employed to break a stone in the bladder, in the operation of lithotomy.

ASTLEY COOPER.

Medical Society's House, Bolt-court,
Fleet-street, March 6, 1826.

I hereby certify, that on the 20th of September last I assisted Mr. Holmes in a case of midwifery, in which there was a disproportion between the head of the child and the pelvis, and passages through which it was to pass. Dr. Conquest's long forceps were applied, and some effect was produced; but it was found that the labour could not be terminated by that instrument, or any kind of forceps, without exerting a degree of force not justifiable under the circumstances of the case. It was therefore deemed proper to lessen the volume of the head by the perforator; this was done, and then Mr. Holmes applied the craniotomy forceps he has recently invented, and in the course of an hour the labour was effected, the instrument retaining its hold of the head of the child until it was extracted.

It may be observed, that in this case there was a want of room in the pelvis; the child was very large; and much difficulty was experienced in extracting the shoulders and body of the child. The whole of the delivery was conducted in the most cautious and deliberate manner.

JAMES FIELD, *Surgeon.*

St. Saviour's, Southwark,
May 12, 1825.

SIR,

Having seen a pair of your craniotomy forceps, I can feel no hesitation in stating, that I think that in judicious hands they are likely to prove a very useful instrument.

I am, Sir, &c. &c.

J. P. Holmes, Esq. JAMES BLUNDELL.

Broad-street-buildings,
March 30, 1826.

I have been shown a pair of craniotomy forceps, invented by Mr. Holmes, and think them very appropriate to the purpose of extracting a dead child through a pelvis which is much deformed; at the same time the instrument displays considerable ingenuity.

JOHN RAMSBOTHAM.

Broad-street-buildings,
March 29, 1826.

I think Mr. Holmes's craniotomy forceps, while they display much ingenuity, are calculated to afford the operator great power in his attempts to extract a perforated head through a deformed pelvis.

FRANCIS H. RAMSBOTHAM, M.D.

29, Conduit-street, March 28, 1826.

I have examined a pair of craniotomy forceps of Mr. Holmes, and they appear to me to be admirably contrived; and that their application, in cases where they are required, will very much facilitate the operation of extracting the fœtus.

HENRY DAVIES, M.D.
Physician to the British Lying-in Hospital.

34, Brook-street, Grosvenor-square,
March 29, 1826.

I have examined a new craniotomy instrument, invented by Mr. Holmes, and think it possesses great ingenuity. It appears to be a perfectly safe instrument, and will enable the operator to exert great force in the extraction of the head through a distorted pelvis.

SAMUEL MERRIMAN, M.D.

Saville-row, March 29.

The instrument which has been shown to me by Mr. Holmes seems well calculated to bring the head of a dead child through the pelvis.

CHARLES M. CLARK.

No. XXII.

IMPROVED FORCEPS FOR THE USE OF DENTISTS.

The LARGE SILVER MEDAL *was this session presented to Mr.* CYRUS FAY, *7, Sackville-street, Piccadilly, for his improved Forceps for the use of Dentists. The following communication was received from him on the subject, and a set of the Forceps has been placed in the Society's repository.*

SIR,

HAVING early in my professional career felt the greatest inconvenience from the imperfections of the instruments usually employed for the extraction of teeth, I was induced to prepare others more accurately adapted to their figure. From an attentive consideration of their structure, I was soon convinced that the *neck of the tooth* was the only part on which the necessary force could be applied with the greatest safety and advantage. Now as the teeth do not all present the same arrangement of parts, it follows that the figure of their necks must also vary; of this fact every anatomist must be convinced. I state nothing new when I say that there are certain teeth formed very much alike, both in the upper and lower jaw, and that of the teeth thus similar to each other there are various classes,

but that each class retains the same peculiarity of figure in all ages, and under all circumstances. Having stated thus much, which I think necessary in order to prepare you for what follows, I beg leave to say, that I have in-invented *a set of instruments accurately, because anatomically, suited* to these several classes of teeth, a desideratum, as I believe, never before accomplished. These instruments are forceps, corresponding in number to the different classes of teeth, and suited to the same classes on the right side, and on the left, in the upper and in the lower jaw, amounting to six in number; but as it is necessary to have two sizes of three of these, the number of extracting forceps is nine, and by referring to the plate, it will be seen with what precision the forceps may be applied to the proper tooth. Thus I found myself in possession of a set of instruments answering the required end, because correctly adapted to the varying form of the parts to which they are intended to be applied.

The next point was to determine *how the power* thus possessed *should be directed.* The line of least resistance is that which coincides the nearest with the average direction of the axes of the fangs; consequently the power should be applied more or less perpendicularly to the jaw-bone.

I do not pretend to say that I am the first person to attempt the perpendicular extraction of teeth, but I hope to show to the Society that I have accomplished that object with the simplest, the safest, and the easiest means.

The advantages which I consider these forceps to possess over all others, are briefly these:

1st. They may, as before stated, be accurately applied to the necks of the several classes of teeth; they are made

to fit the necks only, never making the least pressure on the enamel or body of the teeth, and consequently may be used without any danger of breaking a carious tooth in the attempt to extract it.

2d. They never can slip when once accurately applied on the necks of the teeth, a great practical benefit.

3d. No cutting of the gum, or any other preparatory measure, is necessary, as the edges of the blades of the forceps may be at once brought upon the necks of the teeth.

4th. A provision is made by the beaked form of the extremities of the blades of the forceps designed for the extraction of the teeth having more than one fang, by which means the forceps may be steadily fixed on the remains of a decayed tooth, even when the edges of such teeth are below the level of the gums. To which may be added, that they enable the operator to extract the teeth in the perpendicular direction with a less amount of force than any other instruments.

The manner of using the forceps is shortly this. The forceps having been carefully applied on the neck of the tooth to be removed, the operator is to put a small bit of any light wood across the jaw, of a thickness sufficient to occupy the space between the joint of the forceps and the anterior teeth, then steadily seizing the handles of the instrument, he is to make a gentle semirotatory motion at the same time that he is pressing the handles of the instrument downwards. The semirotatory motion separates more easily the vessels and membranes connecting the fangs to their sockets, and surrounding the neck of the tooth, for, be it remembered, the soft parts, and not the hard, present the greatest resistance to the removal of

the teeth. It might be supposed that the presence of the piece of wood on the anterior teeth, in loosening the diseased one, would produce pain; on the contrary, it is not felt, because the action and re-action are exactly equal between the pressure on the jaw and the resistance of the tooth.

There are other forceps which I beg leave also to submit to the examination of the Society, for a purpose distinct from that for which the instruments already described are designed, and before describing them, I will briefly state what they are intended to accomplish.

In the centre of every tooth is a little cavity, in which is expanded a nervous pulp, forming the principal seat of sensation in that organ; the nervous twigs pass through the roots of the tooth, by very minute passages, into this cavity, where they are spread out. The base of this cavity is situated a little above the level of the neck of the tooth, and it struck me, that when caries had extended so far as to expose this nervous matter to the various agencies from which, in the healthy state of the parts, it is protected, it would be easy to remove that part of the tooth containing the cavity, the seat of the pain, and thus allow the sound roots to remain in their sockets undisturbed, to support the adjoining teeth: as it is a notorious fact, that the entire removal of one tooth, however easily performed, causes the adjoining ones to become prematurely loose, and ultimately to fall out, in consequence principally of the absorption of the alveolar process. Minutely to describe how this happens would occupy too much space, and I mention it merely as a well known fact, to show the value of allowing the roots or fangs of a tooth to remain. This operation I have called the *operation of excision*, and I recommend

it as a most valuable substitute for extraction of the teeth in the majority of cases of caries, but by no means to supersede it altogether, as there are, and must ever be, cases requiring the entire extraction of the teeth, when disease has proceeded beyond a certain point, as, for example, beyond the common cavity which I have cursorily described; or when the jaw itself is diseased.

The instruments employed by me in this operation are forceps accurately fitted, like those for extraction, to the necks of the teeth, but having fine, well-tempered, cutting edges; these edges must be carefully applied on the necks of the teeth, as close to the gums as possible, taking care to keep the edges parallel to the edges of the gums, which are to be depressed a little with the inferior surface of the blades of the forceps, so as to bring the cutting edges fairly beneath the enamel, which, in the the adult, is the criterion of being below the common cavity of the tooth. Then with a gradual application of pressure on the handles of the forceps, the tooth is in an instant snapped off at the neck, and the common cavity, the seat of the pain, is thus removed, leaving the patient a painless, bony surface for mastication, a firm prop for the support of the adjoining teeth, and a basis for an artificial tooth if it should be required. I may mention here a fact never before noticed; namely, that the openings by which the minute canals terminate in the common cavity become, soon after the excision of the crown, *plugged up with bony matter*, which thus affords a permanent protection to the interior of the stump, and presents a continuous and firm surface for after life. In addition to these advantages, the operation is performed, even on the largest teeth, in a moment, and consequently at a *great saving of suffering*, which should be the grand object of all sound surgery.

The following letters from professional gentlemen, many of whom speak from their own personal experience, render any farther observations on my part wholly unnecessary.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. CYRUS FAY.

CERTIFICATES.

SIR, London, Sept. 7, 1826.

In reply to your letter of this morning's date, I have great pleasure in stating, that since the operation which you performed on my tooth I have never experienced the slightest pain, either in that part of the tooth which you suffered to remain in its alveolar socket, or in any of the parts contiguous to it, although for four months previous to the excision of the crown of the tooth I found it impossible to masticate on that side.

With regard to the operation of excision, as performed by you, I have no hesitation in stating that it appears to me to be a very great improvement in that branch of the profession which is connected with the surgery of the teeth.

I am, Sir,

&c. &c. &c.

C. Fay, Esq. J. W. GULLIFER, M.D.

32, Middleton-street, Wilmington-square,
February 7, 1826.

In confirmation of Mr. Fay's new method of operating on the teeth in particular cases, by the excision of the crown or body of the tooth, instead of extraction, I am happy to bear testimony of its complete success in my own person. Since having undergone the operation (upwards of a twelvemonth) I have not experienced any particular uneasiness in the remaining stump, or surrounding gum; and I fully concur in the general approval of the practice of excision in the place of extraction, in all cases where the tooth has not become carious below the margin of the alveolar process, or where there is no reason to suppose a collection of matter at the root of the tooth.

In such cases as render extraction absolutely necessary, I must do Mr. Fay the justice also to declare, that his improved forceps for the extraction of teeth are the best adapted instruments yet offered to the medical public for that purpose.

WILLIAM BRADLEY,
M. R. C. S. London.

4, Chapel-street, Bedford-row,
Nov. 7, 1826.

DEAR SIR,

I am happy in having an opportunity of giving my testimony to the superior method adopted by you of operating upon the teeth. As to the plan of excision, I can only repeat the assurance I gave you at the time of operating,

viz. that I was instantly relieved from the most distressing toothache, without experiencing, during the operation, more pain than the slightest scratch of a pin would have given. Three months have now elapsed, and I have not felt the least inconvenience from the stump.

I have lately examined the stump of a tooth you excised for a medical gentleman (Mr. Wade, of the Westminster Dispensary), which afforded me a practical proof of the justness of your statement of the growth of bony matter over the foramina through which the nerves proceed to the common cavity of the tooth. It is not more than six weeks since you cut off Mr. W.'s tooth, and it would be impossible now to introduce the point of the finest needle into the stump which now remains.

I am sure, when the operation of extraction is necessary, the excellence of your plan cannot be doubted; any man of the smallest ingenuity, who will examine your instruments, must at once admit this.

I am, Sir,

&c. &c. &c.

ROBERT DAVEY,

C. Fay, Esq. *M. R. C. S. London.*

179, Piccadilly, Aug. 23, 1826.

I have seen Mr. Fay cut off a molar tooth of the right side, for a medical friend of mine.

The operation, which is entirely new in this country, was instantaneously performed, and the pain, previously very great, was immediately removed.

I have visited my friend several times since, who declares he has had no uneasiness from the time of the operation.

ROBERT WAKE,
M. R. C. S. London.

DEAR SIR, Berners-street, Feb. 15, 1826.

I have minutely examined your instruments for the teeth, and consider them very superior to all others of the kind, and well worthy the attention of the profession.

Your new and effectual mode of operating by excision has been fully evidenced to me in two of my domestics, on whose teeth you operated satisfactorily.

I am, Sir,
&c. &c. &c.

C. Fay, Esq. JOHN FAITHHORN, M. D.

No. 9, Gerard-street, Soho,
Aug. 21, 1826.

I have much pleasure in bearing testimony to Mr. Fay's improved method of operating on the teeth, his forceps for extraction appearing to me superior to any before invented. Of the new operation by excision I can speak with much confidence, having submitted to it myself, and seen it practised in several other instances.

A lady, for whom Mr. Fay excised four teeth, and whom he afterwards supplied with artificial ones twelve

months since, expresses herself highly satisfied, having experienced no inconvenience beyond a slight tenderness in the gums for about a week, the stumps proving a great support to the artificial teeth.

Of the advantages of excision over extraction there can be little doubt; that is, when the disease does not extend beyond the body of the tooth, the neck being the only place at which excision can be practised with success, as the excised part must include the common cavity.

The stump of the tooth which Mr. Fay cut for me remained slightly tender for about ten days; and on examining it about three weeks afterwards, I found the small cavities, giving passage to the nervous twigs, had become obliterated, by a deposit of bony matter.

The operation of excision, if dexterously performed, that is, if it be done steadily, without moving the tooth in its socket, of course including the common cavity, is scarcely to be felt, as evidenced in a gentleman on whom Mr. Fay operated in my presence a few days since, and who was only aware of the operation having been performed by the cessation of the pain in his tooth.

By excision the sockets of the sound teeth are not deprived of their accustomed support, whilst the form of the jaw is much less injured than in extraction.

R. WADE,

Member of the College of Surgeons.

No. 46, Lincoln's Inn-fields,
Sept. 21, 1826.

After a careful examination and consideration of the instruments and the operations of Mr. Fay, I have great pleasure in stating my conviction of their utility. The mode of extracting the teeth appears to me to be more safe and certain than that which I have seen practised; and the proposal of removing the crown of a tooth is ingenious and, I believe, novel.

JOSEPH HENRY GREEN.

No. 5, New North-street,
August 20, 1826.

SIR,

I have carefully examined the forceps employed by you for the extraction of the teeth, and have no hesitation in saying that they are superior to any I have seen used for that purpose; first, because they are accurately adapted to the shape of the teeth individually, and bear only on their necks; secondly, because with them the teeth may be removed in the direction of their sockets, with greater safety and less power than with any other instruments.

Of your operation of excision I can speak with much confidence; the anatomy of the teeth fully warrants it, and experience has shown that it is very superior to extraction. I have seen you operate on six persons at different times, and I heard them assure you that the operation gave no pain, and that they were perfectly satisfied with the result. Three of these persons I have seen several

times since, and they have assured me that they have experienced no inconvenience from the operation.

I am so satisfied respecting the consequences of this operation, that I would have it performed on myself if circumstances required.

In answer to your inquiry respecting the originality of this procedure, I beg leave to say that I never heard or read of any such an operation before you explained it to me. I have, moreover, examined the principal collections of surgical instruments in Europe, and I have never found any forceps like yours for the extraction of teeth; and I hold that the operation of excision, for the reasons you havestated, deserves to be ranked among the improvements of modern surgery.

E. I. Spry,
Member of the Royal College of Surgeons.

C. Fay, Esq.

Explanation of the Figures of Mr. Fay's Teeth Forceps. Plates VII. and VIII.

Plate VII. figs. 1, 2, and 3, end and side views of a small straight forceps, for the extraction of any of the single-fanged teeth in the upper jaw, whether temporary or permantnt.

Figs. 4 and 5 represent similar views of a forceps, for the same purpose, of a larger size.

Figs. 6, 7, and 8, end, front, and side views of a right angled forceps, for the extraction of the single fanged teeth in the lower jaw.

Figs. 10 and 11, a front and a side view of a similarly shaped forceps of a larger size, which may be used for the extraction of the same teeth as the former in the adult, or of the molar teeth in either jaw, if the tooth to be removed is not decayed below the neck.

Fig. 9, is an inside view of one of the beaks of this forceps, to show the depth of the grooved surface which lays hold of the tooth; this contrivance obtains in all the forceps for extraction, and is intended to prevent the fracture of the tooth by the pressure of the instrument, an accident which would be sure to happen if an acute margin were opposed to the tooth.

Figs. 12, 13, and 14, front, side, and end views of the right angled hooked forceps, for extracting the two anterior molar teeth of the upper jaw on the left side.

Fig. 15, end view of the left single hooked forceps, for the extraction of the same teeth on the right side (see figs. 9 and 10, plate VIII.)

Fig. 16, a front view of the double hooked forceps for the extraction of the two anterior molar teeth on both sides of the lower jaw. The manner in which this instrument embraces the neck and upper part of the fangs of the teeth mentioned, is shown in fig. 8, plate VIII. This instrument is intended more particularly for the extraction of these teeth when decayed more or less below the level of the gums, and to obviate the risk of breaking them, by insinuating the hooks of the instrument below the neck, between the fangs of the tooth. The same may be said of the single-hooked forceps for the extraction of the molar teeth of the upper jaw.

Figs. 17, 18, 19, front, side, and end views of the

hawksbill forceps, for the extraction of the third molar or wise teeth of both jaws.

Figs. 20 and 21, side and end views of the straight *cutting* forceps, for excising the crowns of the single-fanged teeth, especially in the upper jaw.

Fig. 24, front view of a right-angled cutting forceps, for excising the single-fanged teeth of the lower jaw, or the bicuspid of the upper.

Figs. 22 and 23, front and end views of a right-angled cutting forceps, for excising any of the molar teeth either in the upper or lower jaw.

Figs. 25 and 26, the outline and section of one of the pieces of wood used as a fulcrum in the extraction of the teeth in the manner described.

Fig. 27, Examining tenaculum.

Fig. 28, Stilette.

Fig. 29, Gum lancet.

Plate VIII. figs. 9 and 10, represent the manner in which the molar teeth of the right side in the upper jaw are taken hold of by the single-hooked forceps, shown in fig. 15, plate VII. The hook entering between the two exterior fangs, while the plain beak embraces the single internal fang.

Fig. 11, the teeth of the upper and lower jaws, opposite to each of which the numbers of the forceps, in plate VII, are attached by dotted lines, to show the teeth designed to be extracted with each forceps.

Fig. 12, a side view of the jaws, the direction and situation of the fangs of the teeth being shown by dotted lines.

Fig. 13, one of the lower molar teeth of the right side, in which the figure of the internal cavity is shown by

dotted lines; the dotted line *b c*, passing through the base of the cavity. Excision must be performed immediately below this line.

Figs. 14 and 15, represent the appearance of an excised molar tooth. The crown is turned upward, to show the size of the cavity; and the base of it, in fig. 14, shows the minuteness of the orifices through which the nervous twigs pass. These orifices become obliterated by a deposit of bony matter.

PAPERS

IN

COLONIES AND TRADE.

No. I.

COCOA-NUT OIL.

The GOLD CERES MEDAL *was this session presented to* M. LAURENT BARBE, *of the Mauritius, for preparing, and importing Seventy-six Tons of Cocoa-nut Oil. A sample of the oil has been placed in the Society's repository.*

SIR, Downing-street, April 29, 1825.

I TRANSMIT to you inclosed, and request that you will take an early opportunity of bringing under the favourable consideration of the Society, a communication from Lieutenant-General Sir Lowry Cole, respecting the exertions which have been made by M. Barbé to entitle himself to the reward held out by the Society for the production of a certain quantity of cocoa-nut oil, and explaining the cir-

cumstances which have rendered it impracticable to forward that article to this country within the time prescribed by the Society.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. R. W. HORTON.

SIR, Mauritius, Jan. 9, 1825.

In consequence of the encouragement held out to the person who should introduce into England the greatest quantity of cocoa-nut oil, during the year 1824, Mr. Barbé, a merchant of this colony, and owner of one of the small islands dependent on the government of the Mauritius, was induced to extend his manufacture of cocoa-nut oil, in order to compete for the reward offered by the Society for the encouragement of Arts, Manufactures, and Commerce; and in the early part of last year, as proved by the accompanying certificate, Mr. Barbé had prepared one hundred tons of oil, for the purpose of exporting into England. In consequence, however, of a supposition that this liquid is injurious to sugars, no vessel could be found to take it until the present moment. It cannot, therefore, arrive in England until after the expiration of the limited period; and I beg that you will be pleased to make the above circumstance known to the Society, as explanatory of the delay which has taken place.

In soliciting your support in favour of Mr. Barbé's claims, I should add, that every encouragement is due to this gentleman for the industry with which he has perse-

vered in cultivating the cocoa-nut tree, and the endeavours he has made to perfect the manufacture of oil.

His success would, no doubt, induce the proprietors of other islands, dependencies of this government, to attend to the cultivation of the cocoa-nut tree; and I regard it as an object of much importance to the interests of the colony, as likely to afford a very extensive and beneficial branch of industry.

I am, Sir,

&c. &c. &c.

J. Lowry Cole.

A. Aikin, Esq.
Secretary, &c. &c.

CERTIFICATE.

Port Louis, December 1, 1824.

I hereby certify, for the information of his Excellency Sir Lowry Cole, Governor of the island of Mauritius and dependencies, that I have been charged by Mr. Laurent Barbé, manufacturer of cocoa-nut oil, to procure freight for one hundred tons of that oil, to be shipped for England, in order to gain the gold medal, or thirty guineas, as offered for the advantage of British colonies, by the Society for the encouragement of Arts, Manufactures, and Commerce, as published by government notice, under date the 8th of February, 1824; but that I have not been able, for the last eight months, to procure the freight until the present moment, and that I have now engaged for the same on board the Resolution, Parker master, to sail on the 6th of January next.

B. Le Sage, *Agent.*

No. II.

PREVENTING LEAKAGE IN CASKS OF COCOA-NUT OIL.

The THANKS *of the Society were voted this session to Mr.* HUXHAM, *of Travancore, for the following communication respecting his method of preventing Leakage in Casks of Cocoa-nut Oil.*

SIR, Quilon, Travancore, March 21, 1826.

VERY considerable losses having been experienced for a series of years by the shippers of cocoa-nut oil from warm climates to England, in consequence of leakage from the casks in which it was sent, equal at times to forty or fifty per cent., and being engaged in this branch of commerce to a considerable extent, I was induced, some time since, to direct my attention to discover the means by which casks might be rendered sufficiently proof against leakage. After a variety of experiments and trials, I found the following plan to answer my most sanguine expectations.

The hoops of the cask are to be driven on very tight; it is then to be filled (within eight inches of the bung) with oil, and exposed to the action of the sun's rays (in a tropical climate sometimes 160° Fahrenheit) for twenty days or more, as may be necessary, taking care that on the first appearance of leakage the cask be placed on its head, and the hoops again drove; this may be repeated until

the cask is made perfectly tight, when it is to be filled up for shipment. The nature of the oil and the heat will cause the staves to shrink very much during the first ten days.

By adopting this method of proving the casks, vegetable or animal oils may be sent to any part of the world secure from leakage. I have made many shipments to London from this country, and adopted the above method, without experiencing any loss, the casks having arrived quite as full as when they were first shipped.

In corroboration of this statement, I beg to refer you to Messrs. Cockerell, Trail, and Co., 8, Austin-friars, to whom all the cargoes have been consigned.

Should the Society deem this statement worthy of their notice and approbation, I shall experience much satisfaction in having given it.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WILLIAM HUXHAM.

SIR, Austin-friars, March 27, 1826.

We have the pleasure to acknowledge your letter of the 14th instant, requesting to know whether any leakage had occurred on the shipments of cocoa-nut oil sent to us by Mr. Huxham, of the firm of Beaufort and Huxham, Ceylon; and in reply thereto we beg to inform you, for the information of the Society, that, so far as we can judge from the invoices, very little leakage has arisen on this gentleman's shipments.

We may also mention, that previously to Mr. Hux-

ham's joining his present partner, Mr. Beaufort, the deficiency on the latter gentleman's consignments was very considerable, extending sometimes to twenty or thirty per cent.; but that since Mr. Huxham's partnership such deficiency would appear to have nearly ceased.

We are, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. COCKERELL, TRAIL, & Co.

Sir, Austin-friars, May 9, 1826.

We are in possession of your favour of the 6th instant, addressed to our Mr. Larpent, and in reply we beg to acquaint you, that we have communicated with our brokers on the subject, who inform us that the consignments of cocoa-nut oil from Mr. Huxham had not imbibed rancidity from any process it might have undergone; nor did it differ in any way from cocoa-nut oil usually sent from Ceylon.

We are, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. COCKERELL, TRAIL, & Co.

No. III.

PITOYA BARK.

The THANKS *of the Society were voted to* JAMES HENDERSON, *Esq., his Majesty's Consul-General in Colombia, for a box of Bark, from a species of Cinchona that grows in Pitoya, and which is there esteemed to be superior for medical purposes to the Bark from Peru. Specimens of the bark have been placed in the Society's repository.*

SIR, Bogota, April 28, 1825.

I HAVE the honour of transmitting to you a box of Pitoya bark, which, it is here conceived, is superior to the Peruvian bark.

In order to decide this point, so important to the commerce of Colombia as regards this production, I have taken the liberty of sending the specimen to you, in order that the necessary experiments may be made as soon as convenient.

I shall feel obliged by your sending a specimen of the bark, with the result of the experiment, in my name, to the Right Hon. George Canning, and to Lord Lowther.

I have been so much occupied since my arrival here in commercial and political matters, that the Society of Arts will justly regard me as a bad correspondent.

I am, Sir, &c.

JAMES HENDERSON,
H. B. M. Consul General.

A. Aikin, Esq.
Secretary, &c. &c.

P.S. A particular description was to have been sent to me regarding the bark, and as soon as I receive it, I will take care to transmit it to you immediately.

DEAR SIR, Bogota, June, 18, 1825.

I have the honour of transmitting to you a description of the Pitoya barks; the naranjado or orange coloured being the one sent by Colonel Hamilton to your care, for comparison with the Peruvian bark, to which the Colombian growers conceive it to be equal, if not superior.

I am, Sir,

&c. &c. &c.

A. Aikin, Esq.
Secretary, &c. &c.

JAMES HENDERSON,
H. B. M. Consul General.

The orange bark sent by Mr. Henderson is procured from the *cinchona lancifolia* of Mutis, a tree which grows about Pitoya, in the province of Popayan, department of the Cauca. It is there so abundant, that the inhabitants employ scarcely any other wood for the construction of their houses, the formation of fences, and for fire-wood. In Bogota and its vicinity it goes popularly by the name of *Quina tunita,* by which name also it is called in the Flora of Don S. L. Ruiz.

The bark is of various shades of brown, from fawn colour to brownish orange red, and is thick in proportion to the diameter of the branches from which it is obtained.

A few pounds were placed at the disposal of Mr. H.

Hennell, of Apothecaries' Hall (a member of the Society), who reports, that the produce per pound is one hundred and seventy grains of Quinia, and ninety grains of Cinchonia. The common yellow Peruvian bark of the shops is obtained from the cinchona cordifolia, and yields, on an average, about one hundred and fifty grains per pound of Quinia.

It appears, therefore, that the Pitoya bark is better than that in common use, and is likely to form a valuable article of export from the state of Colombia.

No. IV.

SUNDRY ARTICLES FROM SOUTH AMERICA, PRESENTED TO THE SOCIETY BY THE REV. JAMES THOMSON.

The articles in the following catalogue were collected in South America by the Rev. James Thomson, and were by him presented to the Society at the end of the last session. Several of these having been referred to committees, are now under examination, and the results of the inquiry will probably be inserted in the next volume of Transactions.

Sir, London, June 8, 1826.

Agreeably to my promise, I beg leave to send you an enlarged list of the articles I left with you a few days ago. Of the substances enumerated in the enclosed list, there are some which might, I think, be turned to use in the

arts, and I am sure an opportunity of thus turning them to advantage will not be lost by your Society. With this conviction, I would recommend that experiments be made with the Andoqui varnish, with the cabulla, and with the frailejon. Experiments might be made with the first by trying the best means of reducing it to a soft and a liquid state, and the uses to which it might with advantage be applied. Trials might be made with the cabulla, by ascertaining the strength of ropes made from it, compared with those made from other substances. I should think, with a given thickness and weight, a rope or cable made of the cabulla will prove stronger than one made of hemp. If the cabulla rope should turn out stronger than that of hemp, or even equal to it, an article, important to our navy and to our commerce, might in future be got from South America instead of from the north of Europe. The virtues of the frailejon might be tried in medicine and otherwise. I suggest also that the dying qualities of the panti and the chilca be tried, and the nutritive qualities of the quinua.

With every wish for the prosperity of your very valuable Society, and with a desire to promote its object as far as may be in my power,

I am, Sir,

&c. &c. &c.

JAMES THOMSON.

A. Aikin, Esq.
Secretary, &c. &c.

List of Articles from South America, presented to the Society of Arts, on May 31, 1826, *by Rev. James Thomson.*

1. A hat made from a kind of rush. This specimen is from Iipijapi, in the province of Guayaquil, where they are made in great abundance. These hats are much used in Colombia, Peru, and Chile. They are sold at from one to four dollars, according to their fineness and size. This specimen is one of the largest and finest.
2. A new varnish procured from the uncivilized Indians called Andoquies, who live near the sources of the river Magdalena, in Colombia. This bottle contains the vegetable matter as it is taken from the shrub on which it grows. It is kept in water to preserve it moist. When perfectly dry, it is considered useless, as those who work it up have no means of reducing it again to a soft state. When about to be used, it is put into boiling water, to separate from it the oily matter it contains. When effectually freed from the oil, it is taken out, and the varnisher puts a small quantity into his mouth, and keeps chewing it as he goes on with his work. After thus chewing a bit of the varnish for some time, he takes it out, and draws and extends it between his hands till it becomes exceedingly thin, thinner perhaps than the finest paper. In this state it is laid on the article to be varnished and to which it adheres. When used with gold or silver leaf, as is often the case, the gold or silver is placed between two folds of the varnish, and thus applied; the fold on the inside is to make the whole adhere, and that

on the outside is to varnish and protect the gold and silver which shine through, and produce a good effect. The varnish combines readily with various colouring substances, which the people there use with it, as seen in the specimens below.

3. Specimen of the Andoqui varnish, with gold and silver leaf, &c., laid on paper.
4. Three tetumas or calabashes covered outside and inside with this varnish, with gold and silver leaf, and mixed with various colours.
5. A stirrup from Quito, laid with this varnish.
6. A specimen of the dried varnish, and said to be useless, as it cannot be softened. This specimen is combined with the colouring substance, No. 7.
7. Achote, a red colouring substance from the province of Mainas, situated where the river Huallaga falls into the Maranon or Amazon. It is used with the Andoqui varnish.
8. Cabulla negra, or black cabulla (aloe, the maguey of Mexico).
9. Cabulla blanca, or white cabulla. No. 8 grows in temperate climates, and the fibre of the leaf is but short. It is made into ropes, shoes, &c. Almost all the ropes used in Quito and Bogota are made from the leaves of this plant, so much so, that *a rope* is called *a cabulla*. No. 9 has a very long leaf and fibre, extending to nine feet, as in the specimen. This kind grows only in the hottest climates. It is manufactured into ropes of the finer kinds, and into twine and thread.
10. Twine or thread made from the cabulla, and called *pita*.
11. Two ropes made of the cabulla.

12. A purse made of the same.
13. A man's shoe, and a child's, made from this article. This kind of shoes is much used by the common people in Quito and Bogota.
14. The pith of the stem of this plant.
15. Leaf of the palm, called beneficencia. It is remarkably strong, and might, I think, be used in the making of cables with great advantage.
16. A new kind of resin or turpentine from the Andes of Popayan. It is called frailejon, and exudes from a shrub about three feet high. This specimen is in an imperfect state.
17. Frailejon purified.
18. Down taken from the leaves of this plant.
19. A bottle of liquid caouchouc, brought from Quito. (On examination, the caoutchouc proves to be coagulated.)
20. A web made of the same.
21. A specimen of waterproof cloth made from the same.

The caouchouc is an exudation from a large tree (said to be like the cedar) which grows in the hottest climates. This specimen was brought to Quito from the banks of the Daule, which flows into the Guayaquil: the name it generally goes by is *jeve*. When sold in Quito, it is of a dirty white colour, very much resembling butter-milk in consistency and appearance. It will keep, exposed to the air, for two or three months, at the end of which time it coagulates, and forms the caouchouc of commerce. The bottle containing this specimen was sealed in Quito on November 12, 1824, at which time the jeve was a fortnight old, and having

been excluded from the air, it is still in a liquid state. This substance is chiefly used in Quito in making waterproof ponchos, or cloaks, for which it is well adapted. No. 21 is a specimen of this cloth, and consists of two folds of cotton cloth with eleven coats or layers of the caouchouc between. In this preparation the cloth is stretched out on a frame, when the operator, with his hand or a sponge, lays on one coating, which being exposed to the sun dries in a few minutes, and becomes black. When one coating is quite dry, another is laid on, and this is repeated as often as is required. Five layers are laid on each piece of the cloth, then a sixth is laid on one of the pieces, and before it dries, the two pieces are joined, and adhere firmly to each other as one piece. The only use made of the caouchouc in Quito in the black or coagulated state, is by burning it, and collecting the smoke to be used as ivory black.

22. Panti, the leaves of a tree so called, which grows in the province of Quito. It dyes a beautiful brown.
23. A pair of stockings dyed with these leaves.
24. Chilca, the leaves of a tree growing near Quito, which give a beautiful fast green colour to wool.
25. Cotton from Ibarra, in the province of Quito.
26. Cinnamon, from Quito.
27. Sheep's wool, from Quito.
28. Quinua (white), from Quito, used as sago.
29. Ditto (red*), . . ditto.

* The white and red Quinuas are, according to Mr. Sabine, varieties of a chenopodium, the leaves of which are used in many parts of South America as spinach.

30. Cochineal, from Quito.
31. Ditto, from Amboto.
32. Ditto, from Bogota.
33. A medicinal salt, from Guaranda, near Chimborazo. It is said to reduce the goitre.
34. Pereira brava, a medicinal root, said to be useful in stopping hemorrhage.
35. Patten used in Quito and Chile.
36. Tanner's bark used in Bogota.
37. Four Petacas (boxes made of matting), from Bogota.
38. Copal, from the province of Mairas.
39. A piece of the balsam-tree of Peru.
40. A pair of gloves made in Ibarra, near Quito.
41. Three wooden spoons, from Guaduas, near Bogota.
42. Specimen of engraving done in Quito.

No. V.

BURMESE LACQUER.

THE Society have received some bottles of Burmese lacquer, sent from Serampore by Dr. Carey to H. T. Colebrook, Esq., and by that gentleman presented to the Society.

It is used by the Burmese in varnishing cups, bowls, and other vessels made of wood, and is also employed instead of size in gilding their pagodas. It is probably the unprepared juice of a tree, and on certain persons produces the same effects as the juice of the *rhus toxicodendron;* that is, it causes, when handled, a swelling and intolerable itching of the body, which lasts some days.

The liquor, in the state in which the Society received it, is a black substance, of the consistence of tar, on which floats a small quantity of somewhat turbid, watery fluid. Its property of affecting the human body appears to have ceased, for it has been freely handled, and even rubbed by the finger on wood, without producing any inconvenience.

A thin coating of it, laid on the surface of wood, &c., requires long exposure to the sun, or to the damp air of a cellar, to become dry. It is not possible, therefore, to

apply it in the same manner as European varnish is laid on; that is, in from twelve to twenty successive coats, the preceding being dried before the next is laid on. Farther experiments, however, will be made, and the result, if satisfactory, will be published in the next volume.

PRESENTS

RECEIVED BY THE SOCIETY FROM JANUARY 1826 TO JUNE INCLUSIVE.

WITH THE NAMES OF THE DONORS.

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A

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Mr. J. Milton's Bee-hive. See page 10.

IN CHEMISTRY AND MINERALOGY.—CLASS II.

Mr. J. Roberts's improved Safe Lamp for Miners. See page 26.

Mr. J. Cathery's coloured Etching on Ivory. See page 57.

IN MECHANICS.—CLASS III.

Mr. T. Collett's Tag Shears. See page 76.

Mr. G. Hooper's Builders' Level. See page 72.

Mr. Hartley's Hand-rail Sector. See page 142.

Mr. W. Spencer's improved method of letting go an Anchor. See page 84.

Mr. E. Carey's improved Dead Eyes for Shipping. See page 104.

Mrs. Henry Goode's Blind for circular-headed Windows. See page 78.

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Mr. Joshua Jenour's Shot Cartridge. See page 88.

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Mr. D. Magson's Float-valve and Stand-pipe for Water Mains. See page 93.

Mr. C. Fay's Forceps for Dentists. See page 167.

Mr. J. P. Holmes's Craniotomy Forceps. See page 161.

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Mr. Joseph Goodwin's Table for Veterinary Operations. See page 117.

Mr. S. Williams's Drag for Drowned Bodies. See page 114.

Mr. R. Cowen's Apparatus to carry off the Dust produced in Dry Grinding. See page 132.

Mr. J. Alderson's Instrument for describing Arcs of Circles, &c. See page 151.

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Mr. Jos. Long's specimen of British Leghorn. See page 60.

Messrs. J. and A. Muir's specimen of British Leghorn. See page 64.

Mr. G. Manwaring's specimen of British Leghorn. See page 61.

Mrs. Frances Cobbin's specimen of British Leghorn. See page 61.

Mrs. Ingledon's specimen of British Leghorn. See page 61.

Mrs. Lowrey's specimen of double split Wheat Straw. See page 68.

Mr. J. Horne's, jun. Leghorn Plat, made of English Spring Wheat. See page 61.

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   Mr. Alderson's Arcograph.
2. Mrs. Goode's Circular Window Blind.
   Mr. Collett's Tag Shears.
3. Mr. Skinner's Safe Coach.
4. Mr. Spencer's mode of letting go an Anchor.
5. Mr. Towson's Banking for Chronometers.
   Mr. Williams's Drag for Drowned Bodies.
6. Mr. Cowen's Apparatus for Dry Grinders.
7. Mr. Fay's Forceps for Dentists.
8. Ditto.
   Mr. Holmes's Craniotomy Forceps.
9. Mr. Manwaring's Hydraulic Pressure Engine.
10. Mr. Edwards's Levelling Machine.
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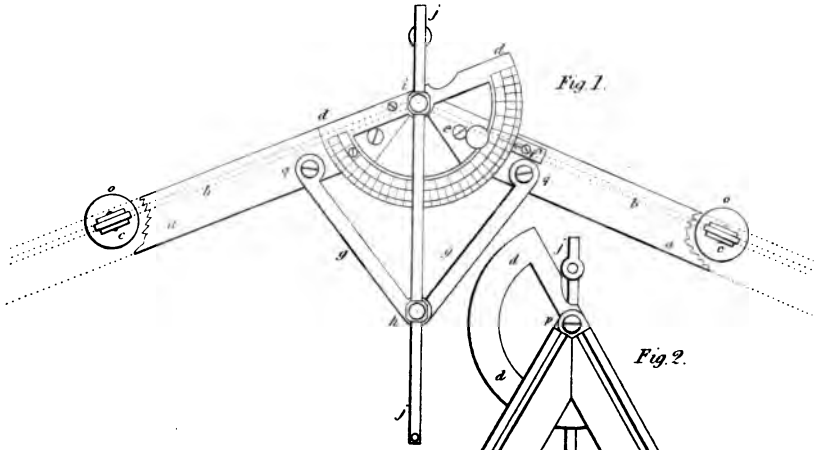

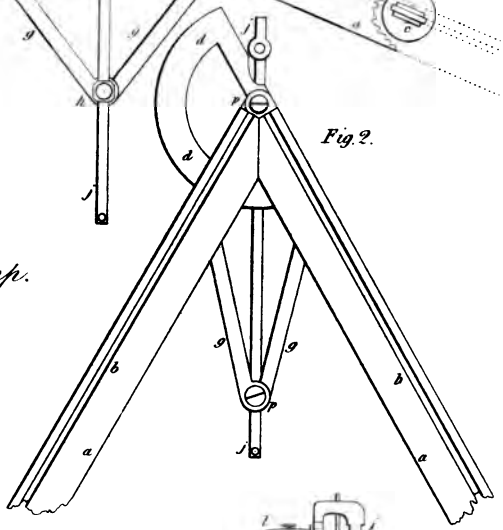

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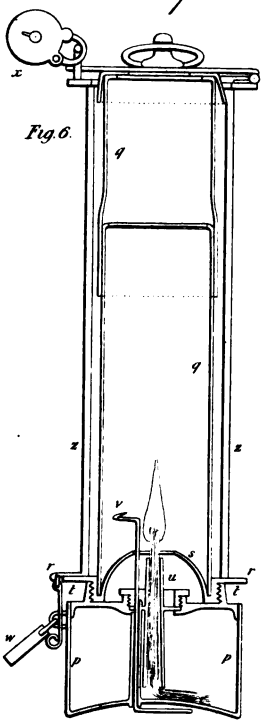
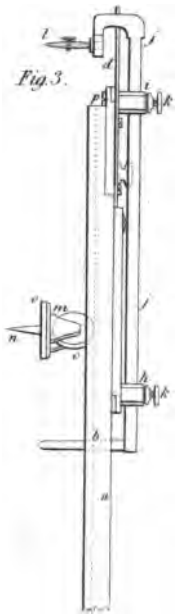
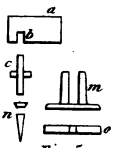
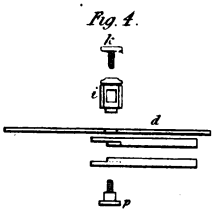
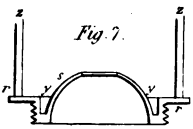










Drawn by Cornelius Varley.

Mr. Goode's Window Blind.

Fig. 1.

Fig. 2.

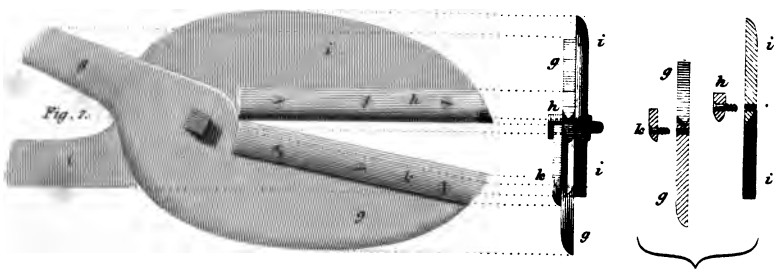
Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Mr. Collet's Tagg Shears



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Mr. Skinner's Safe Coach.

Fig. 1.

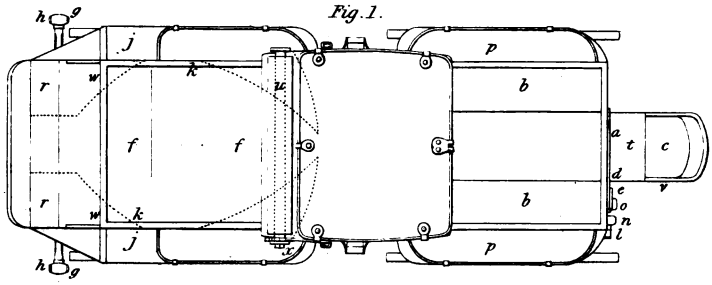


Fig. 2.

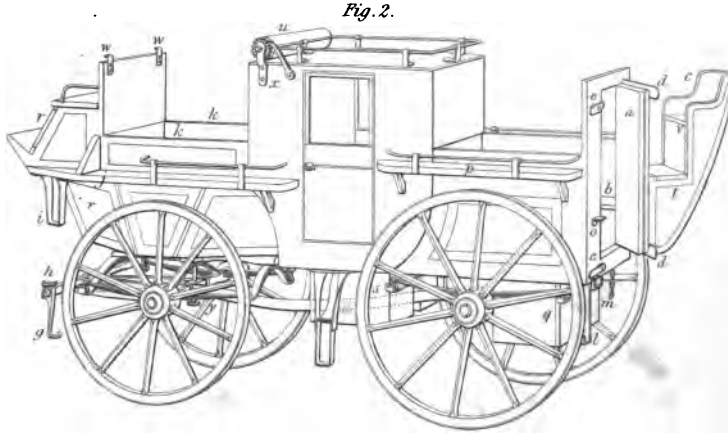
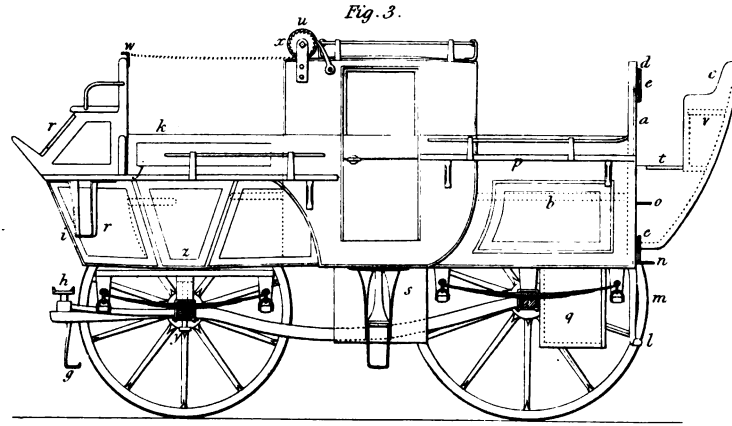


Fig. 3.



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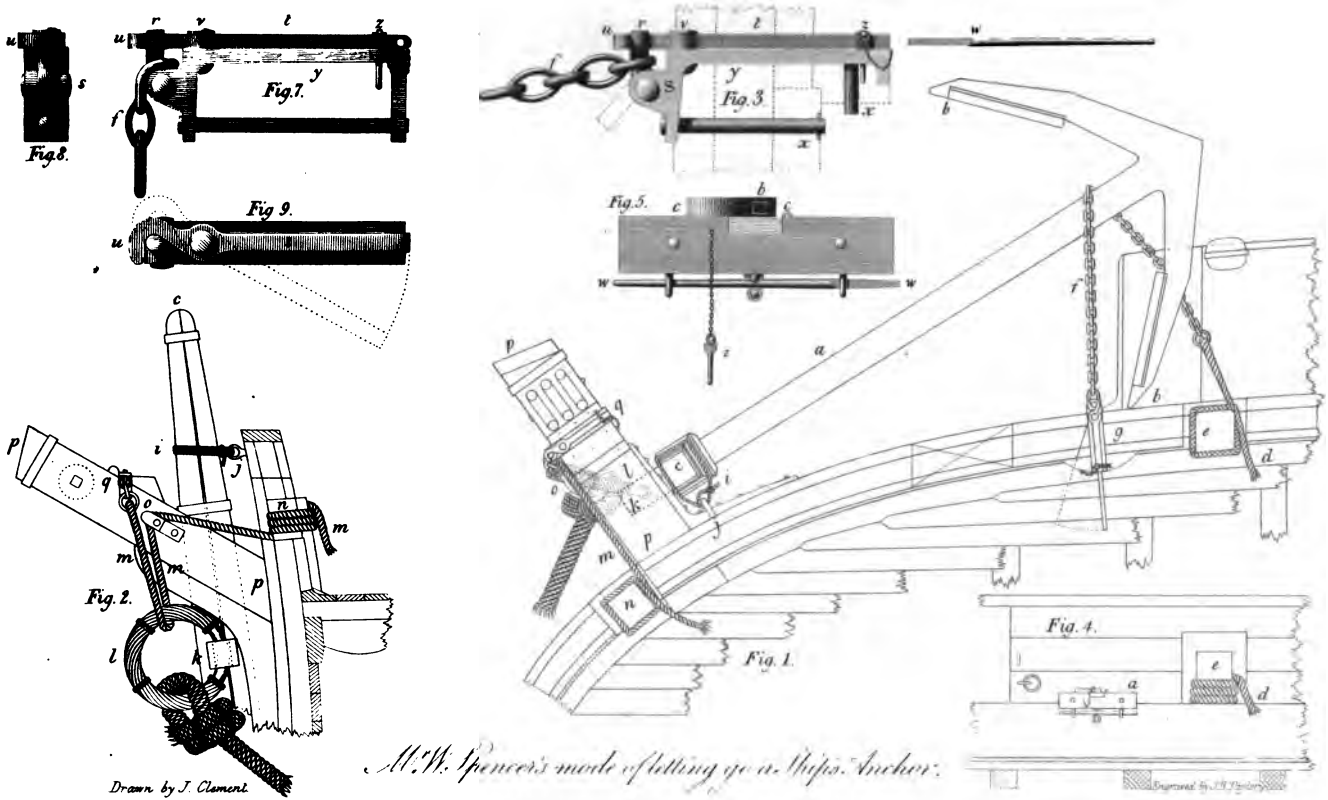

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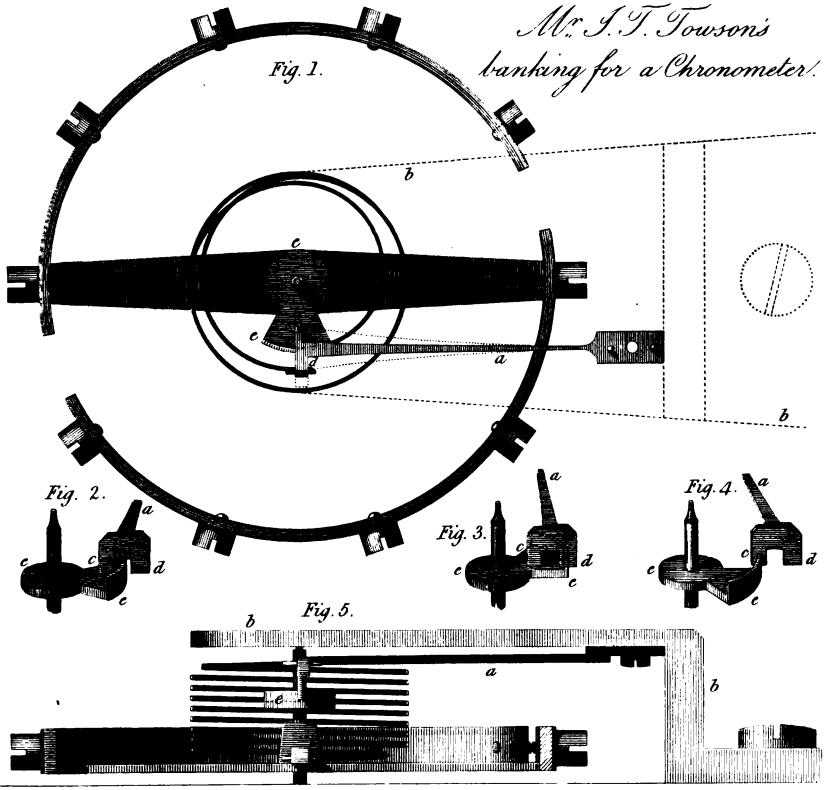

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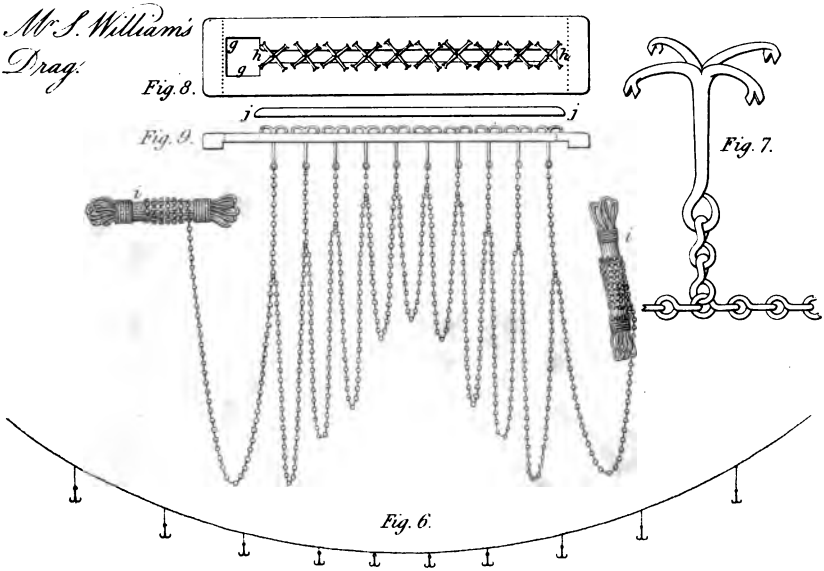

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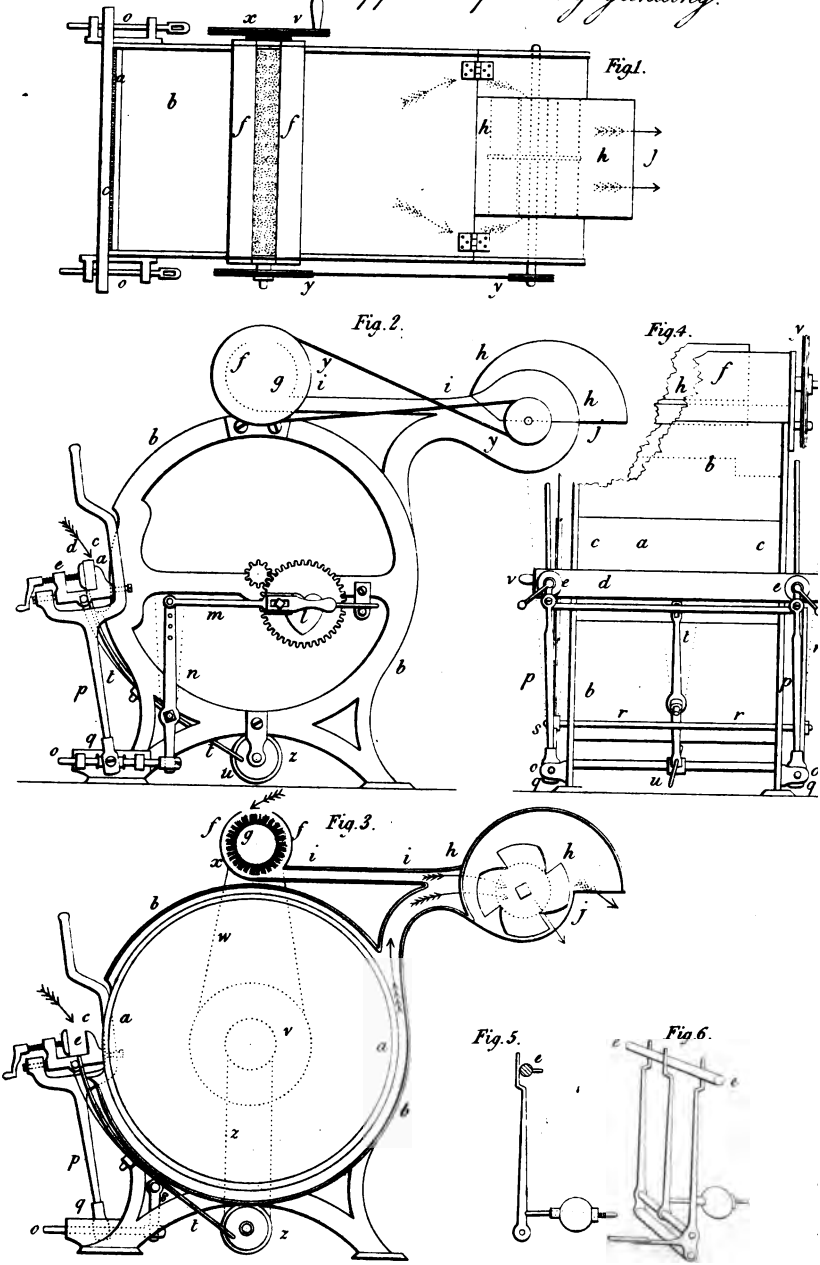

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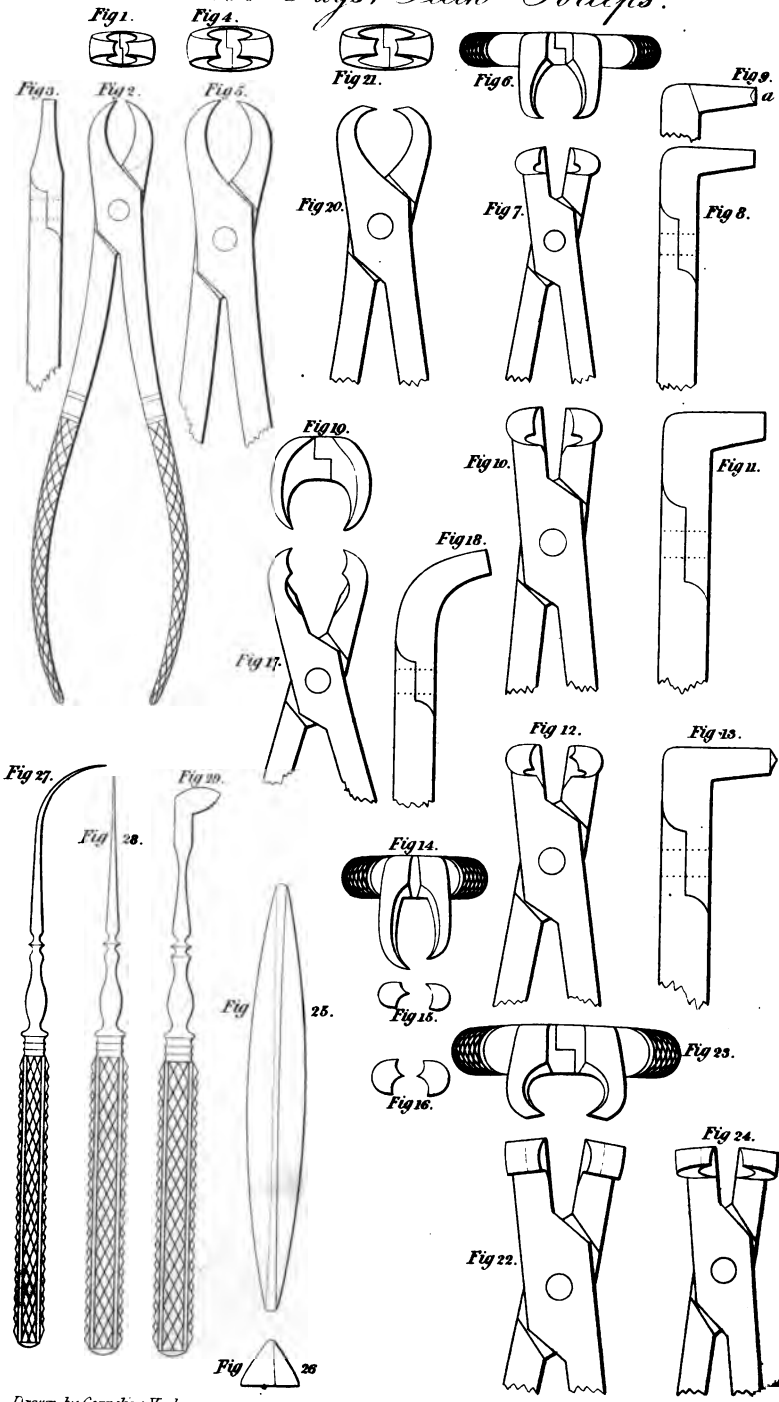

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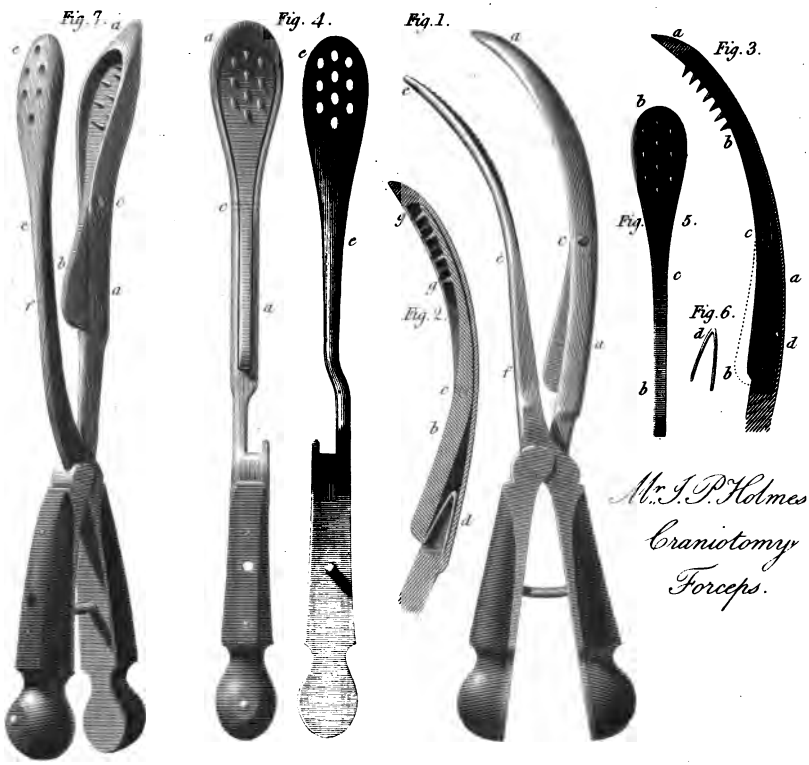

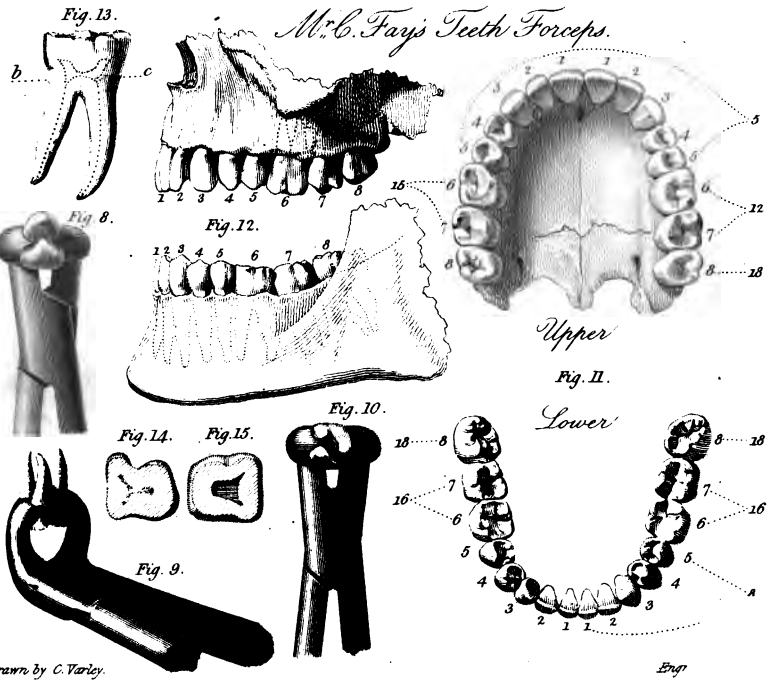

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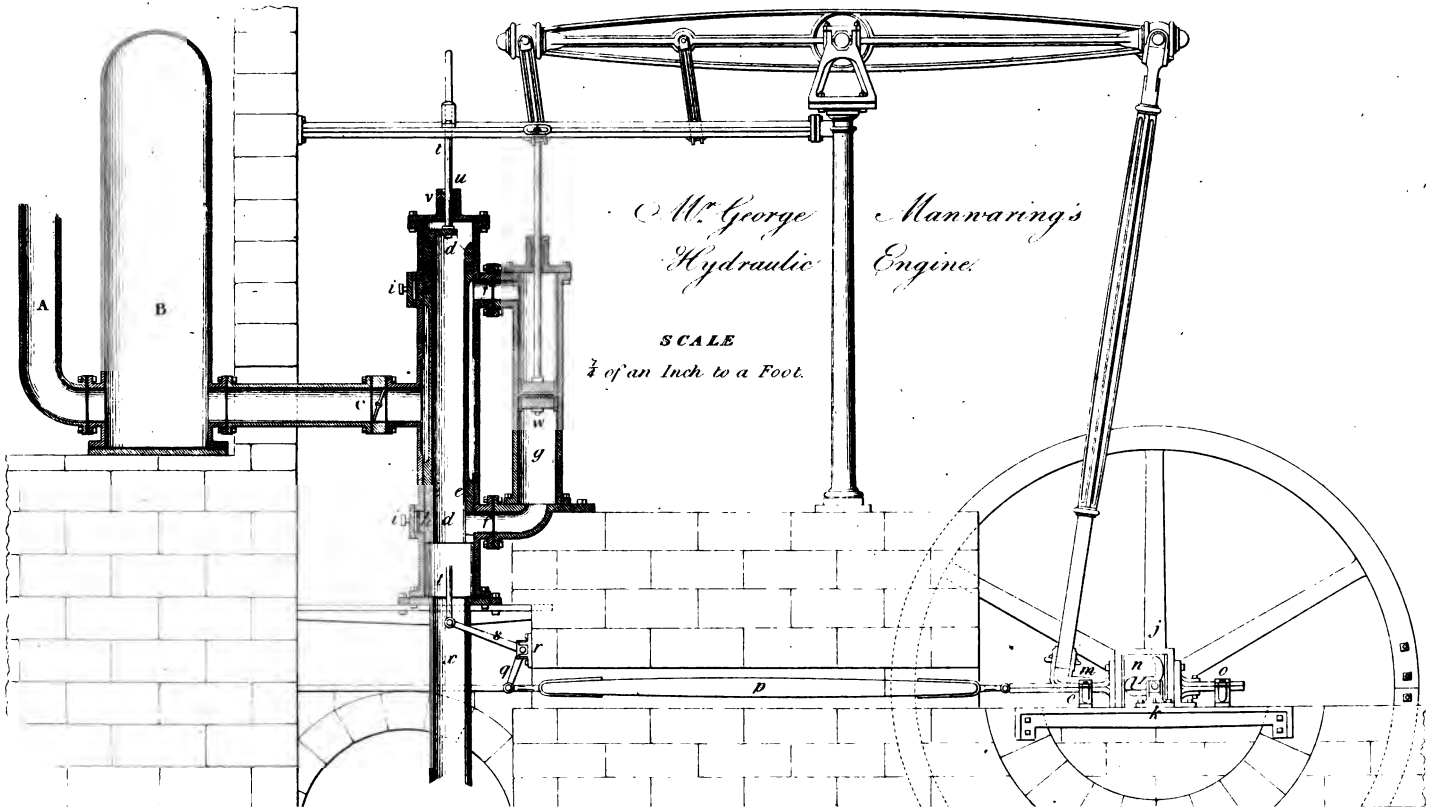
Mr. George Manwaring's
Hydraulic Engine.
SCALE
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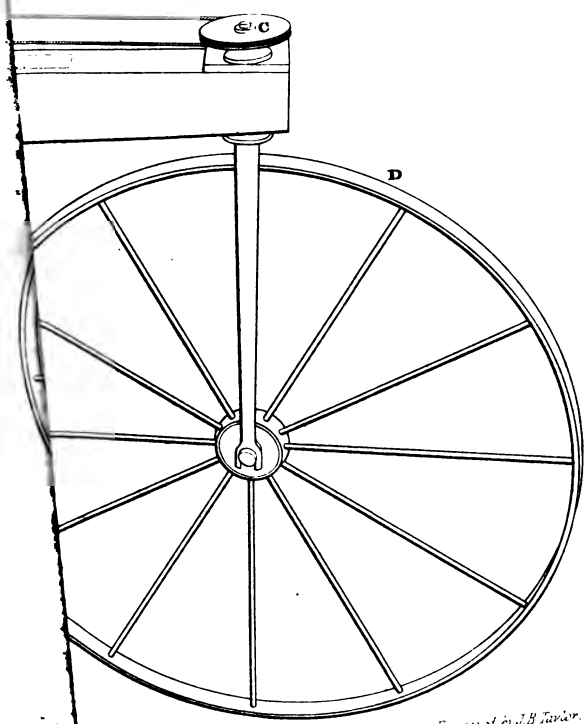

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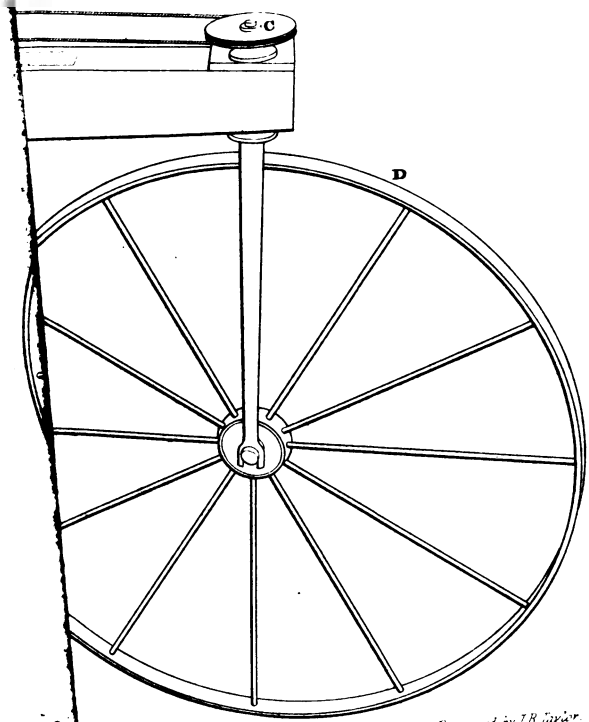

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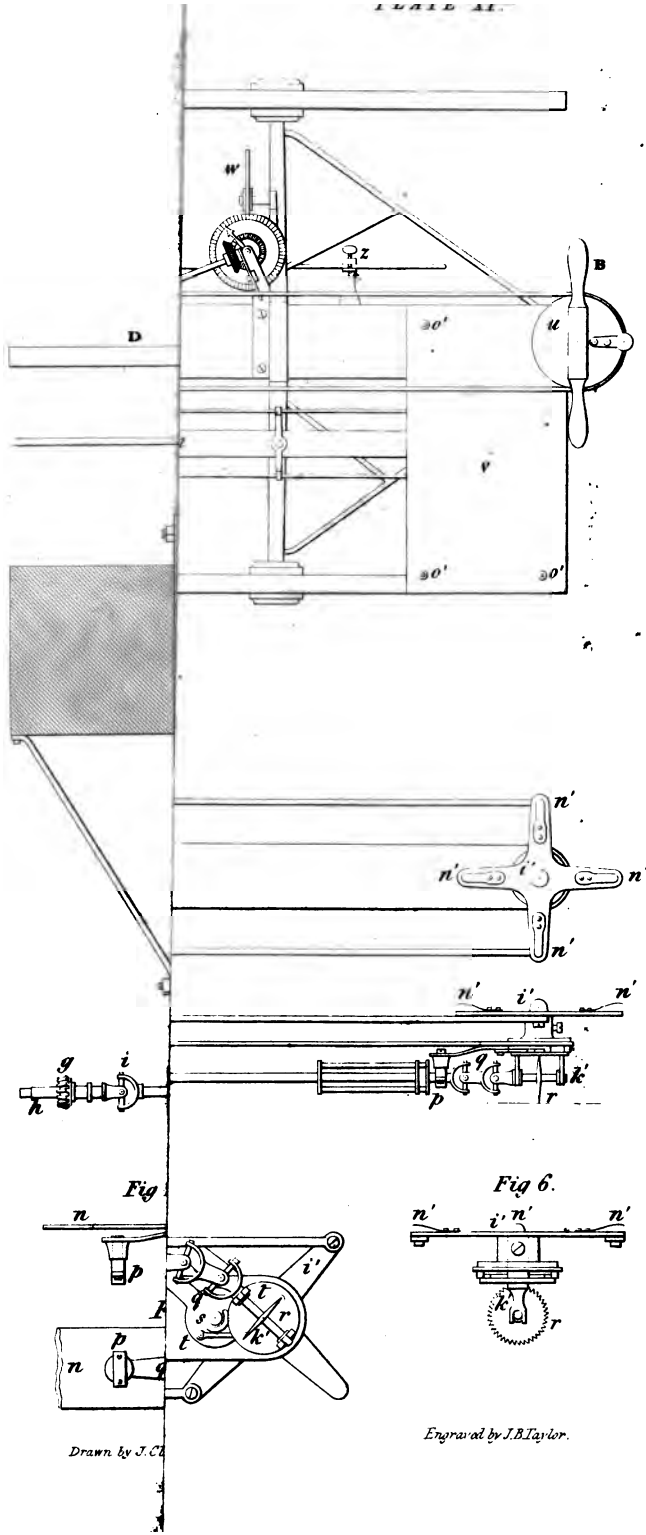
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Fig 6.
Drawn by J. C
Engraved by J. B. Taylor.

A

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OF

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